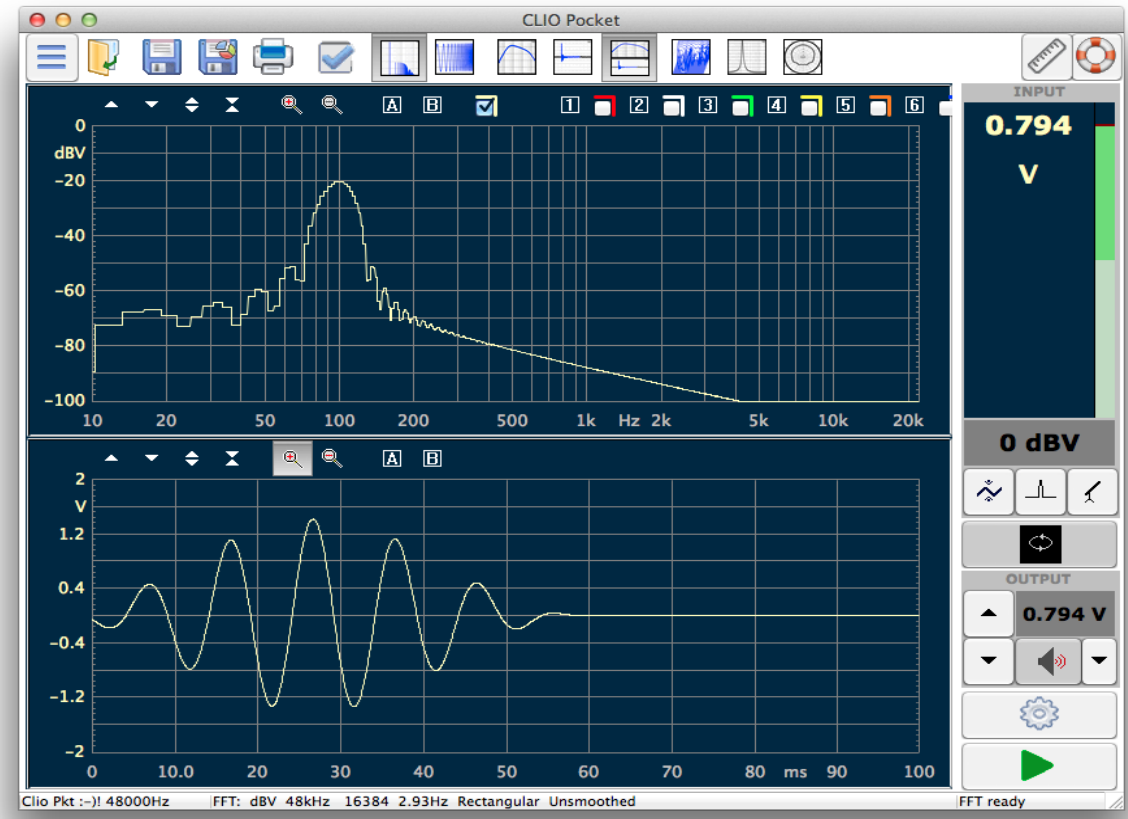
CLIO

ELECTRICAL & ACOUSTICAL TESTS



CLIO Software

Release 1.1
Version Pocket

Survival Guide

AUDIOMATICA

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INSIDE THE CLIO POCKET BOX

You should receive your CLIO Pocket housed in a plastic box like this:

Inside the box you find:

- The CP-01 Audio Interface
- The CLIO Pocket CD with software and drivers
- The Microphone MIC-02
- One USB 2.0 cable
- One RCA to RCA 2.7m long microphone cable
- One RCA to alligators impedance cable

TECHNICAL SPECIFICATIONS

CP-01 AUDIO INTERFACE

GENERATOR

24 Bit sigma-delta D/A Converter

Frequency range:	1Hz-45kHz
Frequency accuracy:	better than 0.01%
Frequency resolution:	0.01Hz
Output impedance:	150Ω
Max output level (Sine):	13dBu (3.46Vrms)
Attenuation:	0.1 dB steps to full mute
THD+Noise(Sine):	.008%

AC ANALYZER

24 bit sigma-delta A/D Converter

Input range (full scale):	+40dBV down to -40dBV
Max input acceptance:	+40dBV (283Vpp)
Input impedance:	64kΩ (5.6kΩ mic)
Phantom power supply:	8.2V

DC ANALYZER

12 bit A/D Converter

Input range:	± 6.5V

MISCELLANEOUS

Sampling frequencies:	96kHz and 48kHz.
Connections:	analog RCA in and out
Digital connection:	USB 2.0 port
Power supply:	USB powered (480 mA)
Dimensions (cm):	9(w)x12(d)x2.5(h)
Weight:	0.3 kg

MIC-02 MICROPHONE

Type:	Condenser electret
Accuracy:	±1 dB, 20 Hz to 10 kHz ±2 dB, 10 kHz to 20 kHz (direct field)
Maximum level:	130 dB SPL
Dimensions:	8 mm diameter, 12 cm long

CLIO POCKET SOFTWARE REL.1.1 UNDER X-RAYS

LOG CHIRP ANALYSIS

- Amplitude, frequency and time calibrated response.
- Chirp length: 16384, 65536 points
- Impulse length range: 1.36s down to 170ms
- Frequency range: 10Hz to 45kHz
- Frequency response units: dBV, dBu, dBRel, dBSPL
- Impedance response units: Ohm
- Frequency and time simultaneous display, analysis and post-processing
- Frequency smoothing (1/48 to 1 fraction of octave)
- Phase response (Normal, Minimum and Excess)
- Auto-Capture Delay with manual interactive fine-tuning
- Group Delay response (Normal, Minimum and Excess)
- Time Impulse response
- Step response
- Schroeder impulse decay
- Energy Time Curve
- Quasi-Anechoic acoustic response with start and stop time window selection
- Time window: Rectangular or Auto-Half Hann tuned to impulse max
- Continuous loop measurements for easy interactive tuning of systems
- AutoStore to Overlay function to track up to 10 curves on screen
- Math processing: Add file
- Math processing: Divide by file
- Math processing: Merge High and Low frequency response
- Math processing: dB Shift
- Math processing: MIB (Microphone In the Box) technique
- Save Impulse time data to wav file
- Export ASCII data to file or clipboard to be imported in simulation software
- Export Graphic data to file or clipboard for easy reporting

FFT AND RTA ANALYSIS

- Narrow-band FFT analyzer
- FFT size: 4096, 16384, 65536 points
- Acquisition range: 1.36s down to 42ms
- Frequency range: 10Hz to 45kHz
- Measurement units: dBV, dBu, dBRel, dBSPL
- Time window: Rectangular, Hanning, Hamming, Bartlett, FlatTop
- Average: linear to target count or continuously exponential
- Average count: 1 to 9999
- Continue average function to add next linear count
- Max or Min hold function
- Frequency and time simultaneous display and analysis
- Frequency smoothing (1/48 to 1 fraction of octave)
- Real-Time fraction-of-octave analyzer (RTA)
- RTA bands: 1/3 or 1/6 octave
- Event trigger with programmable delay and threshold
- OneShot event trigger function
- Save acquired time data to wav file
- Export ASCII data to file or clipboard
- Export Graphic data to file or clipboard for easy reporting

SIGNAL GENERATOR AND OUTPUT CONTROLS

- Dedicated Generator Panel with on-the-fly controls
- Plays standard wav files
- Highly optimized waveform calculator
- Waveform: Sinusoid, FFT-bin optimized, bursted and tapered
- Waveform: Two Sinusoids with relative amplitudes
- Waveform: CEA burst with cycles control, FFT-bin optimized and tapered
- Waveform: White noise
- Waveform: Chirp, Lin or Log, up to 256k size and start and stop frequencies
- Waveform: Pink noise, FFT matched, pseudorandom, low crest factor
- Waveform: All Tones, FFT matched, low crest factor
- Dedicated main window surface with output controls
- All controls speeded up by hot keys
- Direct 3-digit input of output level
- Button control for 1dB or 0.1dB steps

INPUT METER AND CONTROLS

- Free-running Voltmeter and Sound Level Meter with bar graph
- Measurement units: V, dBV, dBSPL
- Voltage reading range: from few μV to 100V RMS
- Interactive L-C-R meter
- Measured components: Resistors, Capacitors, Inductors
- Direct measurement of microphone sensitivity
- Direct measurement of reference voltage
- Dedicated main window surface with input controls
- All controls speeded up by hot keys
- Button control input sensitivity in 10dB steps
- Input-Output Loop button
- Input polarity inversion
- Input gain autorange
- Microphone power supply

WATERFALL

- Decay analysis with 3-D gesture-controlled swiveling graph
- Multiple windows allowed for easy comparison
- Analyzes Log Chirp Impulse response or FFT time data
- Classical Cumulative Spectral Decay for loudspeakers characterization
- Frequency smoothing (1/48 to 1 fraction of octave)
- Reference operation
- Fully configurable frequency, time and amplitude axis
- Number of spectra: 15 to 120

THIELE & SMALL PARAMETERS

- Interactive Control Panel to simplify operation
- Free Air parameters
- Added Mass or Known Volume methods for full parameters estimation
- Direct measurement of ReDC.
- Multiple windows allowed for easy comparison

SYSTEM

- Software operates native under Windows or OSX
- Touch and gesture compliant software design
- Hardware relies on dedicated USB driver
- Ultra stable, glitch-free, streaming operation
- Self-calibration with comparison to Audiomatica Labs calibration conditions
- Stored calibration parameters trace international standards
- Assistance warning in case of any component run out of spec with time
- Security warning in case of any unauthorized parameter change

1 CLIO POCKET INSTALLATION

1.1 MINIMUM PC CONFIGURATION

The CLIO CP-01 audio interface running the CLIO Pocket software can be installed in any personal computer with the following minimum system requirements:
– Pentium IV class processor (suggested minimum 2GHz)
– One free USB 2.0 port
– 1024x786 video adapter
– Microsoft Windows XP, Vista, 7, 8, 8.1, Apple Mac OSX

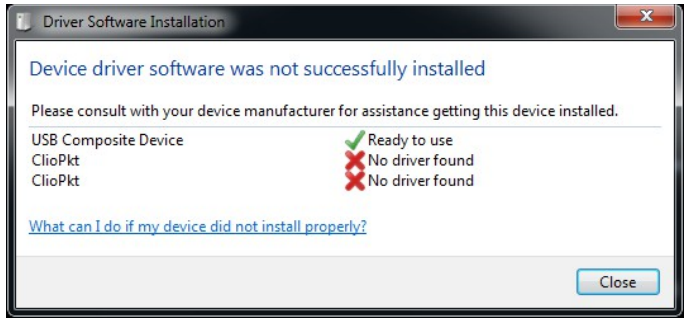
PLEASE FOLLOW THESE PROCEDURES TO INSTALL AND GET STARTED WITH YOUR CLIO POCKET!

1.2 DRIVER INSTALLATION UNDER WINDOWS

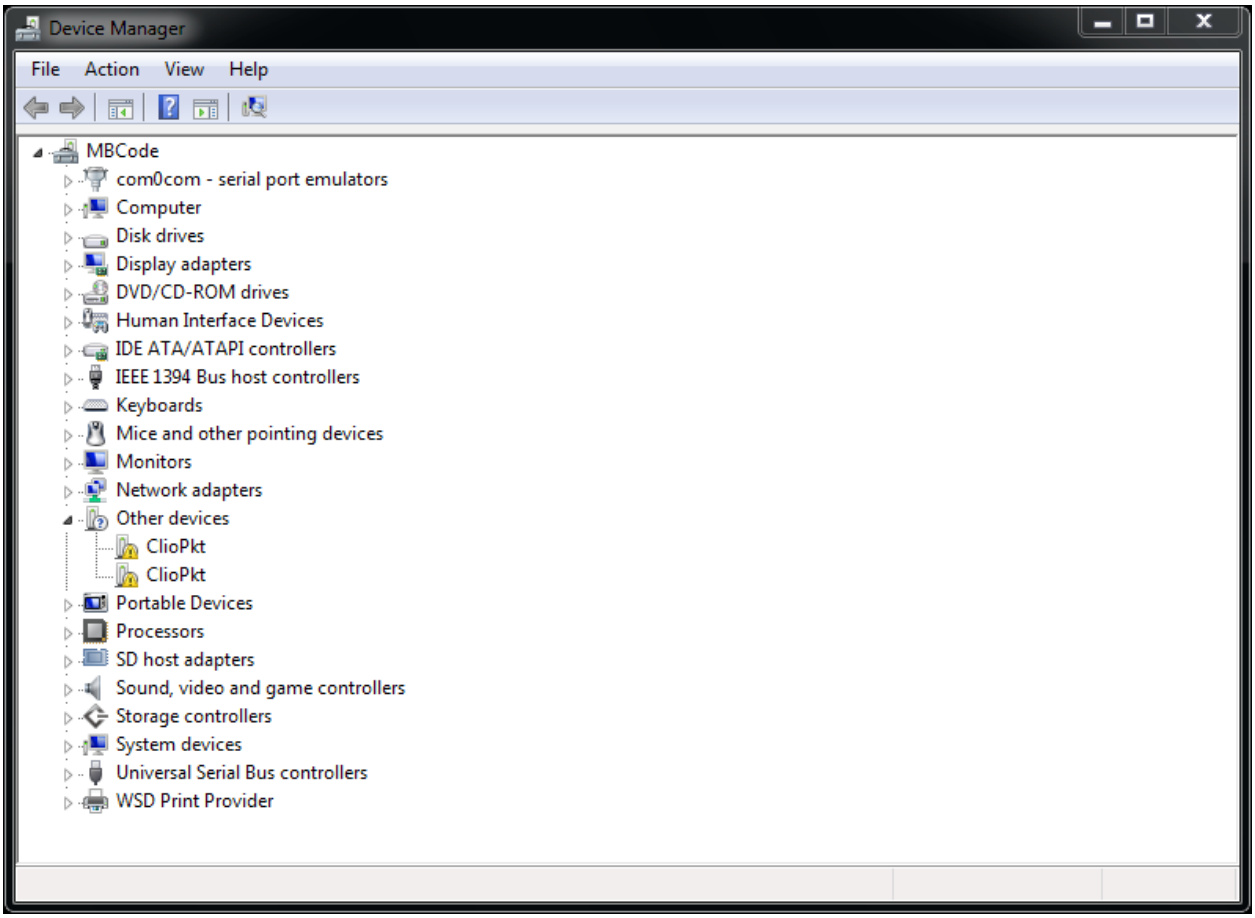
Connect your CLIO Pocket to a free USB 2.0 port on your PC.

You should hear the classical sound of plug and play device; note: *the front panel blue LED should NOT be lit at this time*.

After the initial automatic driver detection only one device should be found by Windows, the USB Composite Device; two more devices, named ClioPkt should be installed manually.

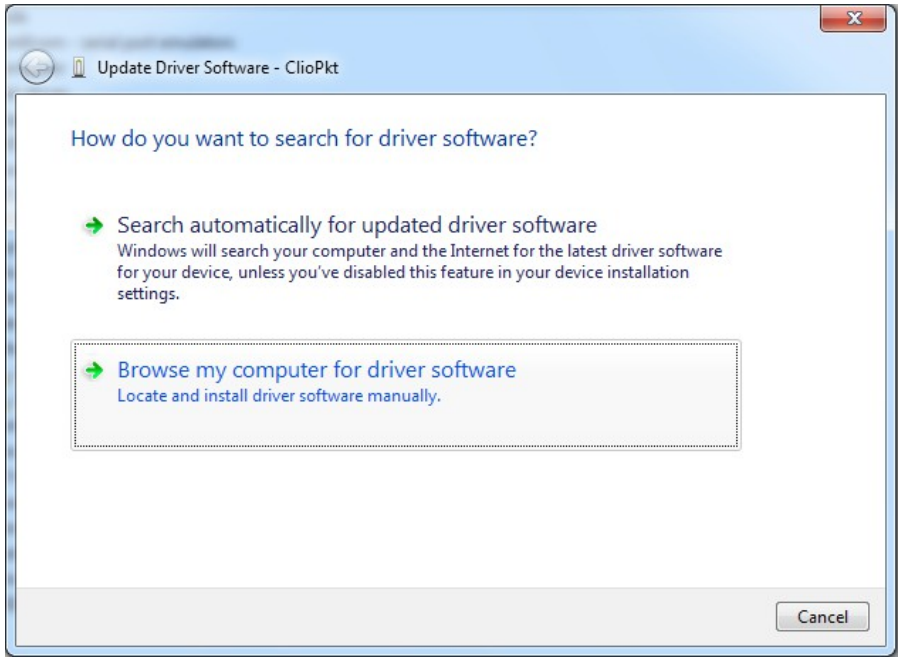

Driver Software Installation
Device driver software was not successfully installed
Please consult with your device manufacturer for assistance getting this device installed.
USB Composite Device
ClioPkt
ClioPkt
Ready to use
No driver found
No driver found
What can I do if my device did not install properly?
Close

Open Device Manager (type *devmgmt.msc* from Run prompt or click Control Panel>System>Device Manager):



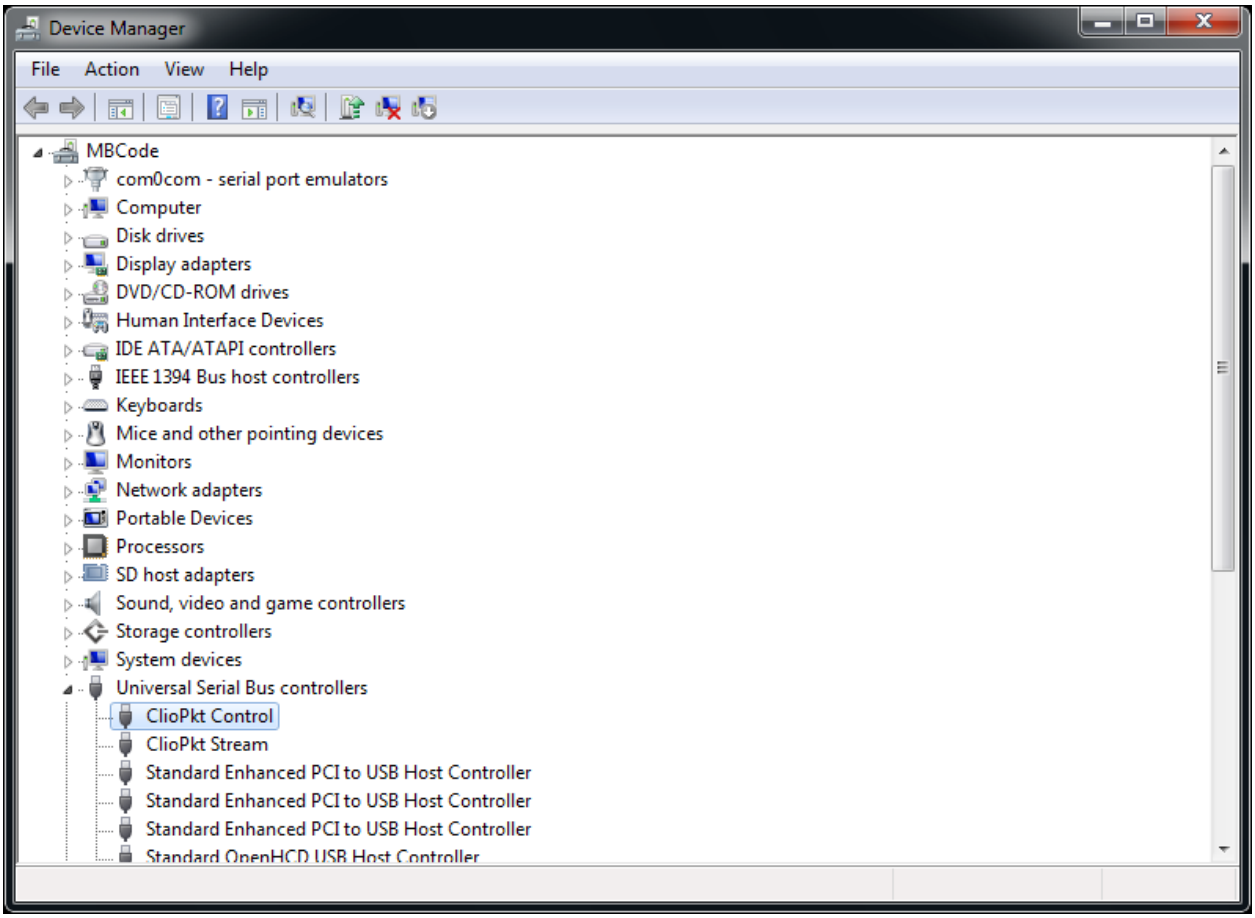
Right-Click on each ClioPkt device under Other Devices and choose Update Driver Software.

At the successive prompt:


Update Driver Software - ClioPkt
How do you want to search for driver software?
Search automatically for updated driver software
Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.
Browse my computer for driver software
Locate and install driver software manually.
Cancel

Browse your computer and point to the folder inside the installation CD where the proper drivers are located (usually \Windows\Driver\Vista_7_8).

At the end of installation you will get the **ClioPkt Control** and **ClioPkt Stream** entries within Device Manager:



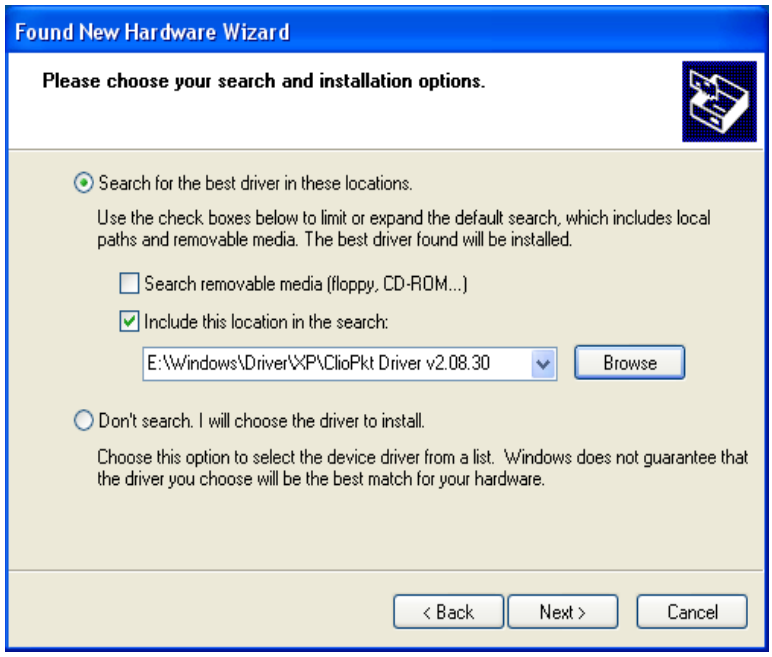
Your driver installation was successful!

1.3 DRIVER INSTALLATION UNDER WINDOWS XP

Installing under XP differs as, when you plug in CLIO Pocket, the Found New Hardware Wizard starts

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

The wizard will direct you while installing the two drivers needed. You should *Install from a specific location* and point to the driver folder for XP on the CD (usually \Windows\Driver\XP) and then answer **Continue Anyway** to the prompt about Windows Logo testing.


Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
E:\Windows\Driver\XP\ClioPkt Driver v2.08.30
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

At the end please refer to above 2.2 and inspect Device Manager to verify proper installation of the drivers.

1.4 SOFTWARE INSTALLATION UNDER WINDOWS

This paragraph deals with **software installation.**

Be sure to have administrative rights when installing CLIO Pocket.

Launch the CLIO Pocket installer running the *ClioPktSetup.exe* file from the installation CD:

CLIO Pocket Setup
Welcome to the CLIO Pocket Setup Wizard
This wizard will guide you through the installation of CLIO Pocket.
It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.
Click Next to continue.
Next >
Cancel

At the end of the wizard the CLIO Pocket software should be installed smoothly; take note of the installation folder (usually C:\Program Files\Audiomatica\ClioPkt).

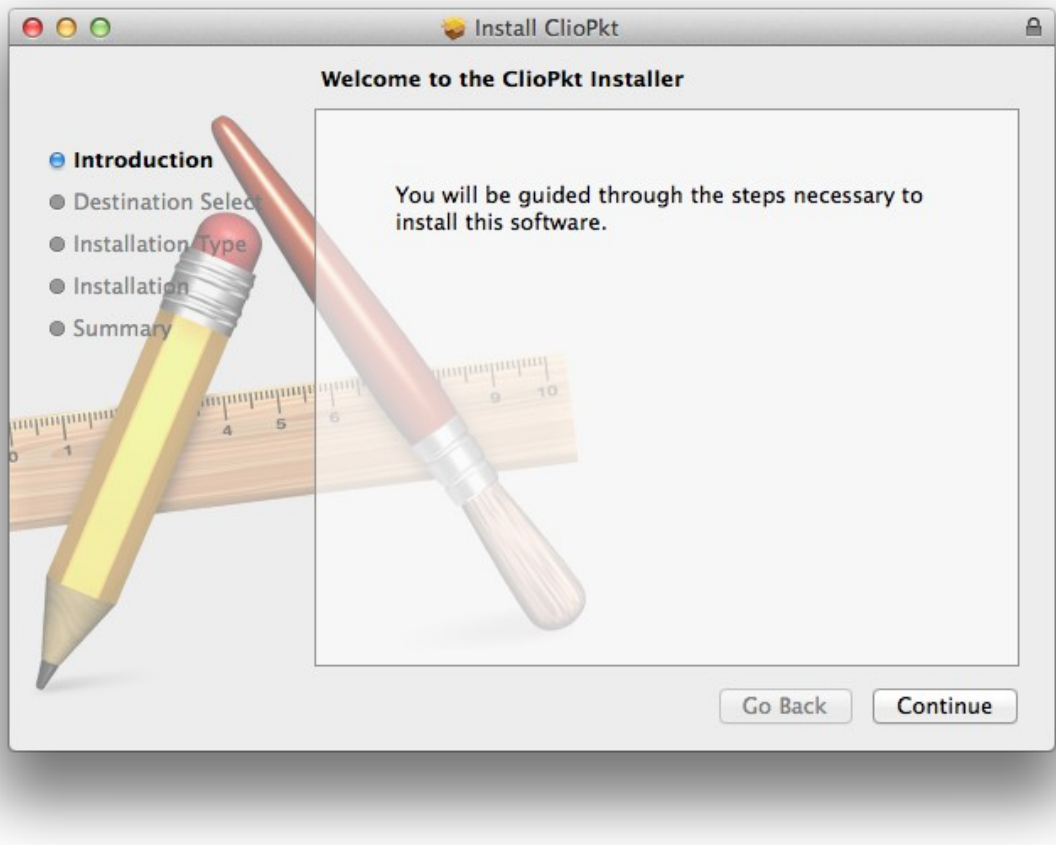
1.5 INSTALLING UNDER OSX

Connect your CLIO Pocket to a free USB 2.0 port on your Mac. Note: *the front panel blue LED should NOT be lit at this time.*

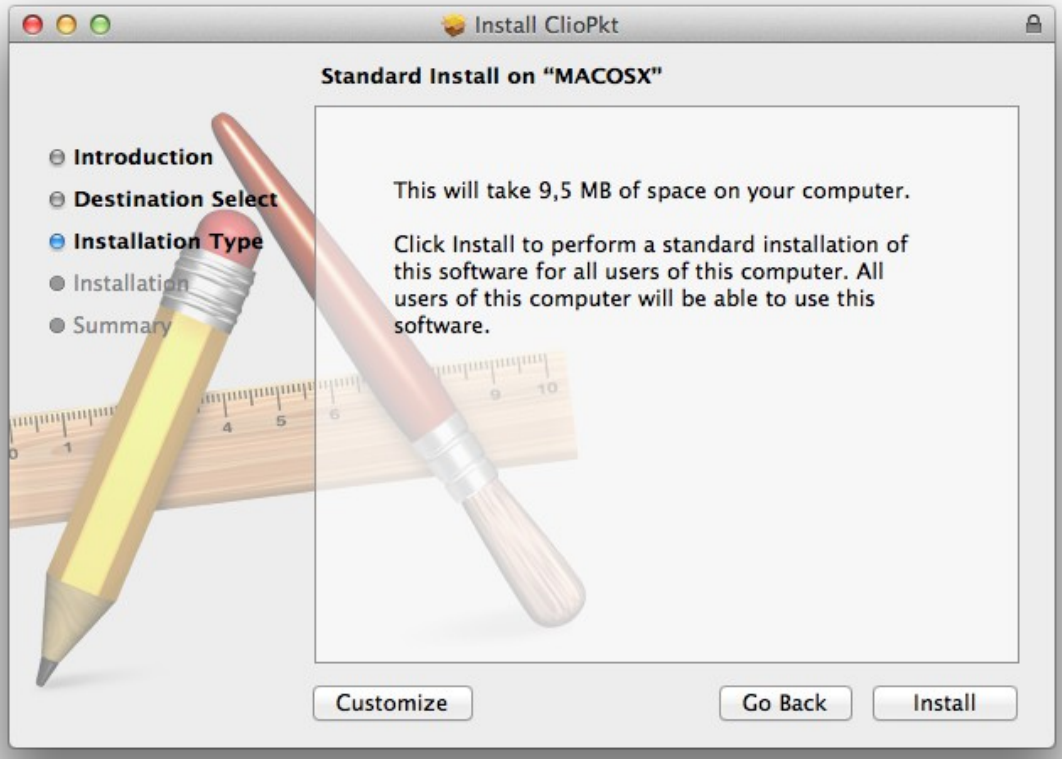
You may find the OSX installer (ClioPkt.pkg) in the CLIO Pocket CD under the /OSX folder.

Double click on the ClioPkt package icon to open the installer:

The installer window should open:



Click on Continue to proceed with the installation.


Install ClioPkt
Standard Install on "MACOSX"
Introduction
Destination Select
Installation Type
Installation
Summary
This will take 9,5 MB of space on your computer.
Click Install to perform a standard installation of this software for all users of this computer. All users of this computer will be able to use this software.
Customize
Go Back
Install

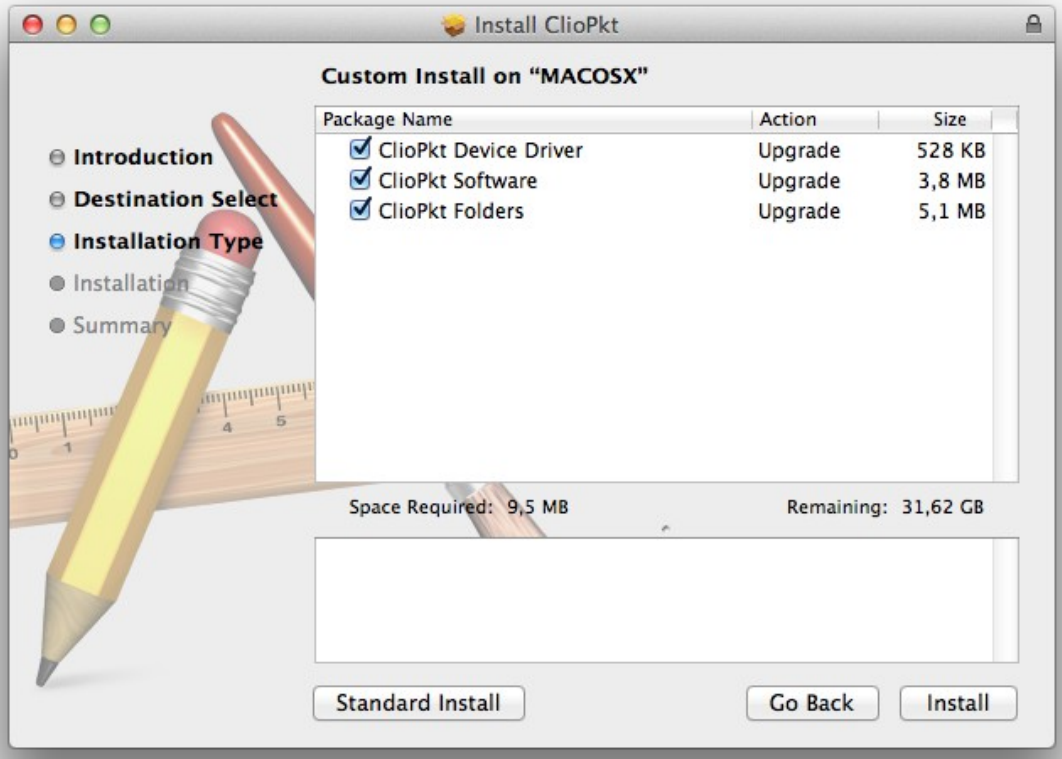
Under OSX the installation is performed in three steps:

1 Device driver installation (device driver files are copied under /usr/local/lib/ folder)

2 ClioPkt application installation (application bundle is copied under Applications folder)

3 Ancillary files and folder structure installation (files and folders are copied under /Library/ClioPkt/ folder)

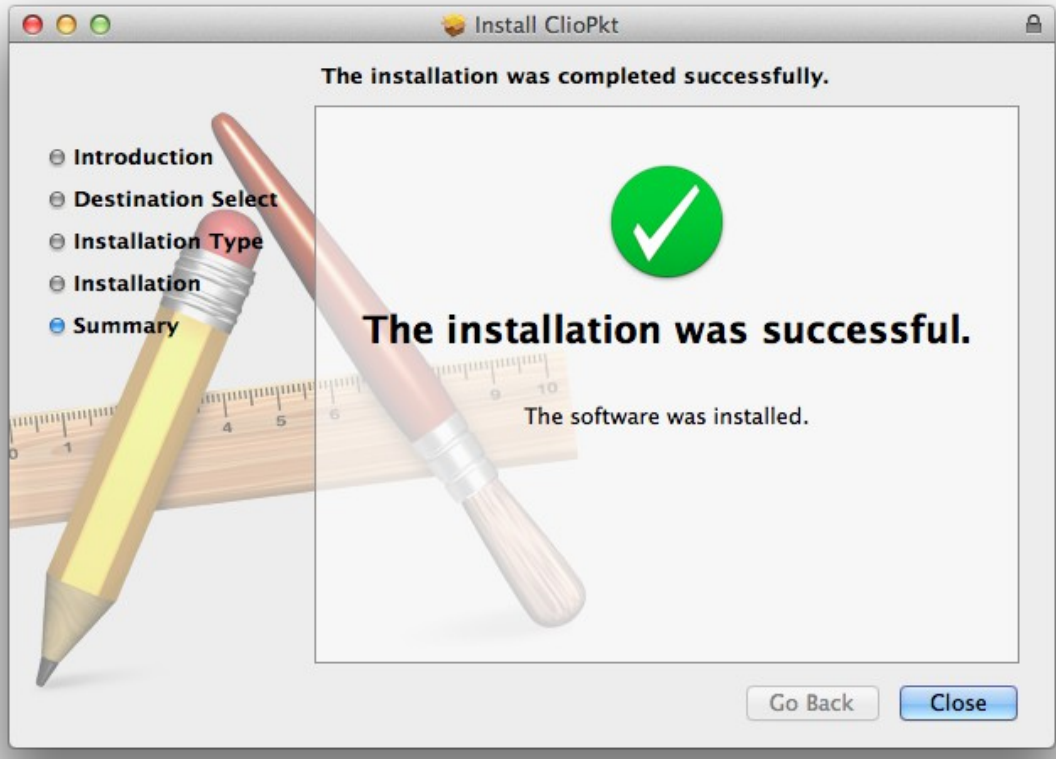
Click on Install to proceed with the Standard Installation elsewhere click on Customize to select which items you want to install.



Click on Standard Install to go back to the Standard Installation, or select the items you want to install and click on the Install button.

In order to install the Device Drivers the system root password should be typed:

At this point the installer copies the folders and files to the local installation media. At the end of the installation you should get this message:



The installation is successful, depending on your OSX version you should find the ClioPkt application under user /Applications/ folder and Launchpad.

1.6 HOW TO UNINSTALL CLIO POCKET UNDER OSX

At the end of the installation you should have the following items added to your system:

1 Device drivers library:

$ ls /usr/local/lib | grep libftd

libftd2xx.1.2.2.dylib

libftd2xx.dylib

2 ClioPkt application bundle:

$ ls /Applications/ | grep ClioPkt

ClioPkt.app

3 Directory structure

$ ls /Library/ClioPkt/

Cal Help Signal Tables Temp

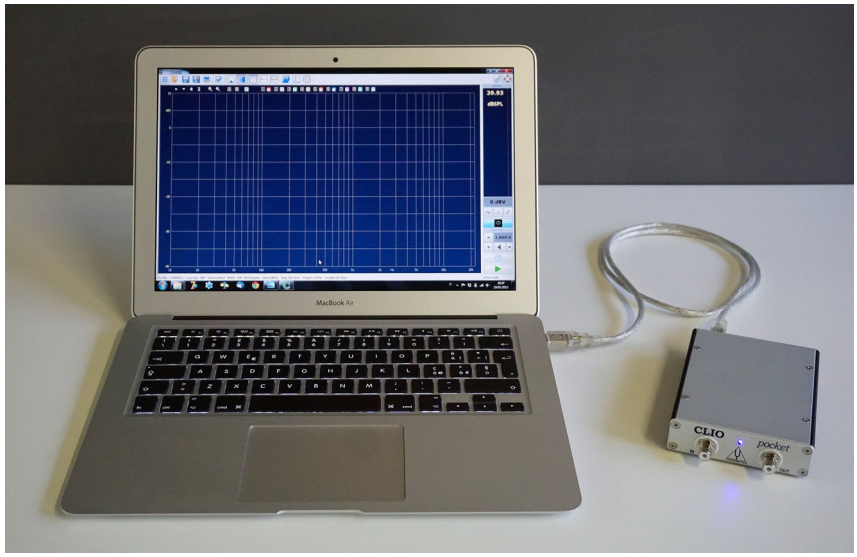
In order to completely uninstall CLIO Pocket from your Mac, and cleanup the files copied by the installer, you should delete all the files above.

2 CLIO POCKET MAP

2.1 RUNNING CLIO POCKET FOR THE FIRST TIME

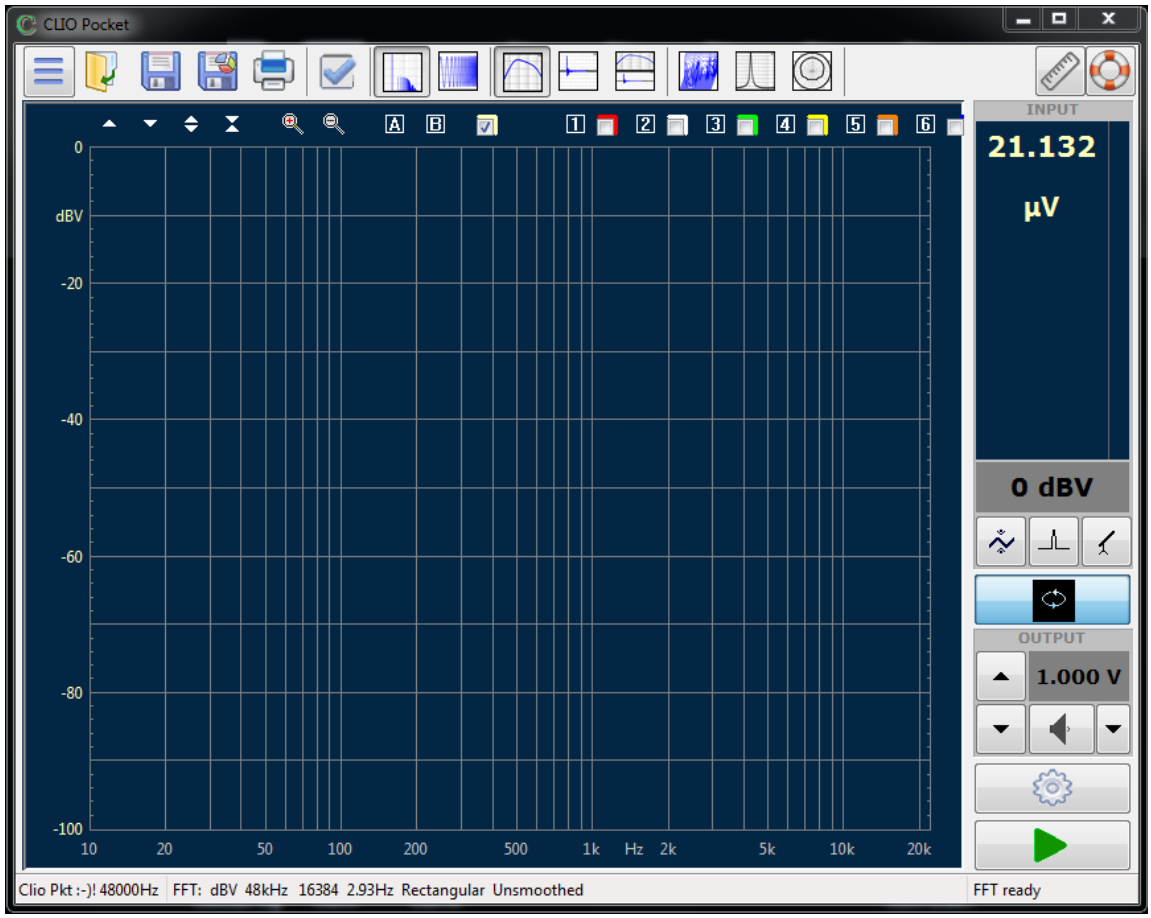
If you have completed the preceding installation procedures, you are ready to run CLIO Pocket!

From the **Start Menu** choose **Programs**, then **CLIO Pocket** and click on the CLIO icon.

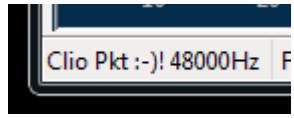


Upon a successful installation the front panel blue led should now light up, you may hear the internal relays clicking and the program should start smoothly and present the main desktop.

2.2 CLIO POCKET DESKTOP

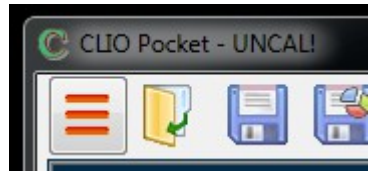


Particular attention should be paid to the **corners** of the main window of CLIO Pocket; there useful and important, sometime vital, information is displayed. The **lower left corner** keeps information on the hardware status. An *happy face* tells you that the device is running OK:



while a *sad face* is given **in case the hardware is not connected** or various problems are found:

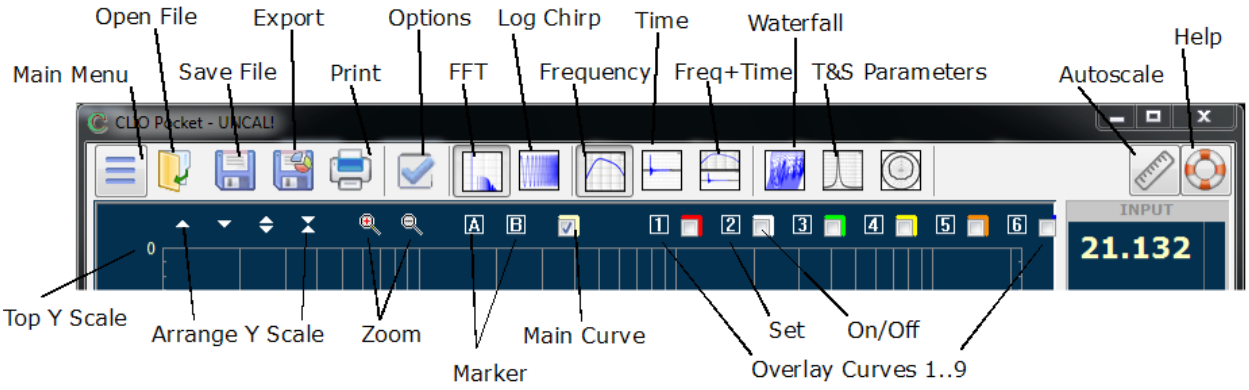
The **upper left corner** gives information inside the title bar of the window:



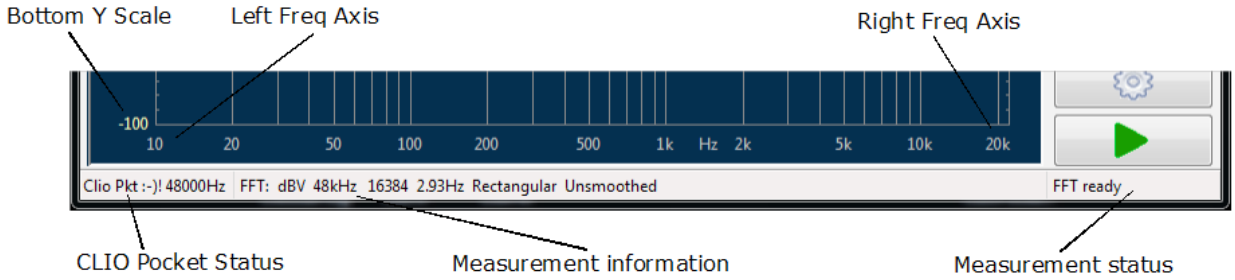
In the above figure, the software tells you that it has not been calibrated or that it needs to be calibrated. This is the default state when first running CLIO Pocket.

Here we briefly describe the buttons and other mouse controllable areas of CLIO Pocket Desktop. Feel free to click on each of these and experiment yourself.

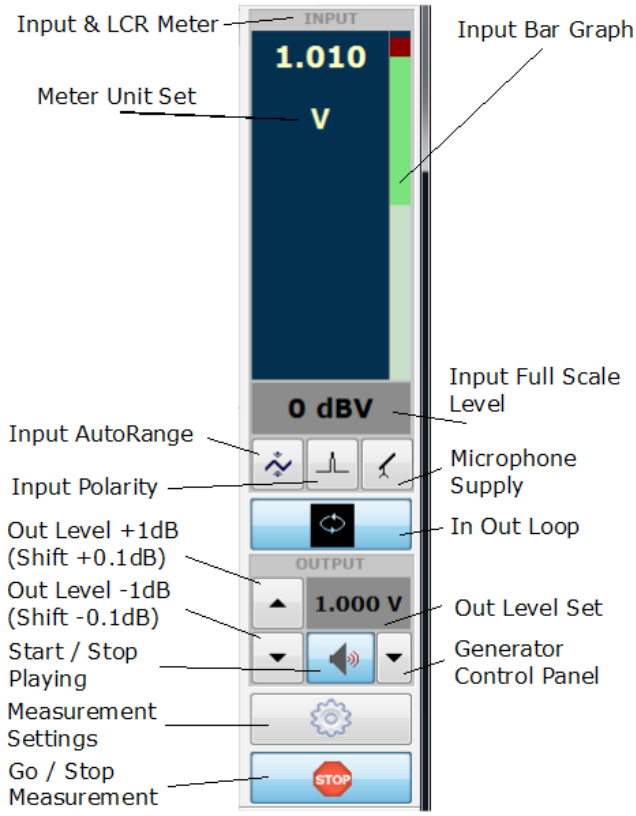
Upper bar, graph buttons and controls.



Lower bar and graph controls.



Side bar.



2.3 HOT KEYS

ESC
Immediately kills the generator. Equivalent to releasing

F1 Invokes CLIO Pocket manual. Equivalent to

F2 Saves a measurement file relative to the active measurement. Equivalent to

F3 Loads a measurement file relative to the active measurement. Equivalent to

F5 Recalls measurement Options. Equivalent to

F6 Enables/disables autoscale. Equivalent to

F7 Decreases the output level by 1dB. Equivalent to

SHIFT+F7
Decreases the output level by 0.1dB. Equivalent to SHIFT+

F8 Increases the output level by 1dB. Equivalent to

SHIFT+F8
Increases the output level by 0.1dB. Equivalent to SHIFT+

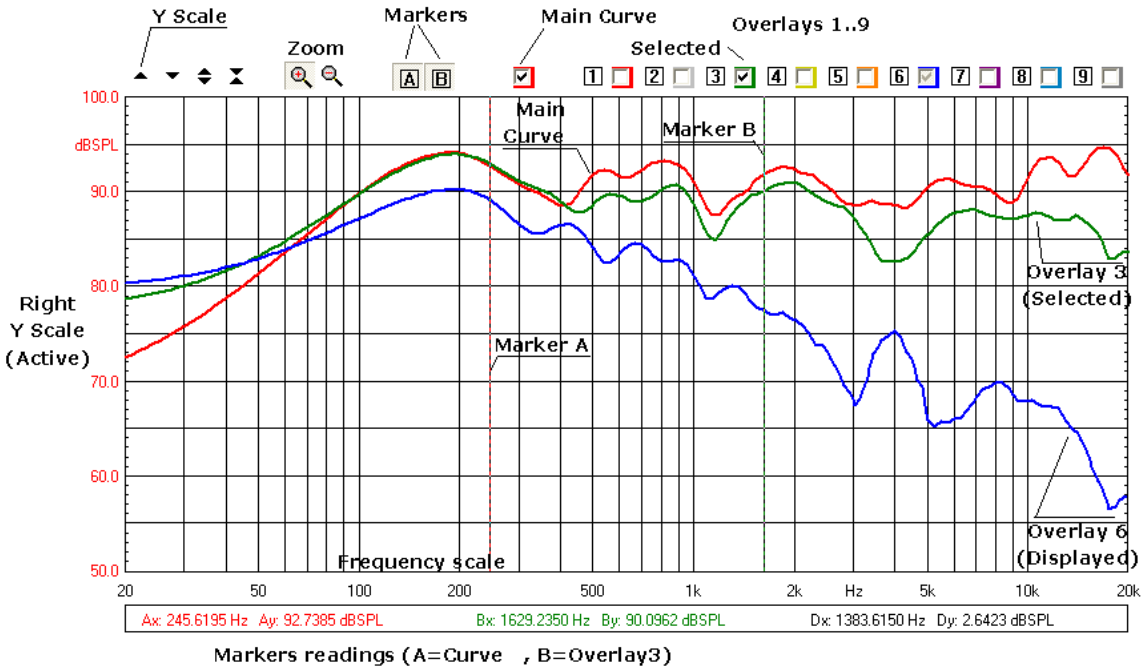
F9 Increases input acceptance by 10dBV.

SHIFT+F9
Decreases input acceptance by 10dBV.

G Starts measurement. Equivalent to

T Stops interactive measurement. Equivalent to

2.4 THE GRAPH DISPLAY



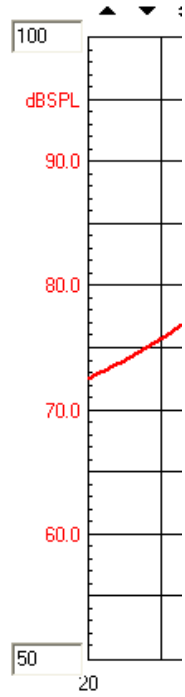
The figure explains the main objects found in a Frequency response measurement display. Inside the graph you find the **main curve** which reflects an executed (or loaded from disk) measurement; up to nine **overlays curves** which are stored by the user and can be controlled interactively, the two **markers** which are activated by clicking on the respective buttons. Above the graph itself we find several buttons and checkboxes which divide into three main categories: Y scales controls, main curve, zoom and overlays management.

Each overlay can be displayed, hidden or selected with the relative checkbox.

Marker A reads the main curve; marker B has a twofold operation: it reads the selected overlay, if present, otherwise it reads the main curve again.

Beside and below the graph we find the Y Scales, the Frequency (or Time) Scale and Marker Indicators. The Y scale is of the same color of the main curve selected.

It is possible to directly input the Y scale values; to activate the input boxes simply click on the scale extremes.



HOW TO ZOOM

1) Click on the Zoom+ button.

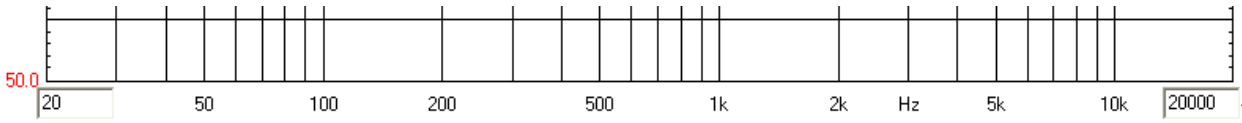
2) Position the mouse and PRESS the left mouse button at the beginning of your selection and **keep the mouse button pressed**. Don't just click otherwise you get a warning message!

3) With the mouse button pressed move the mouse until the second selection point.

4) Now release the left mouse button.

Be careful: you must have the button pressed from point 2) to point 4)!

It is also possible to zoom by direct input of the Frequency extremes of the scale; to activate the input boxes simply click on the scale extremes.



THE CHIRP TIME DOMAIN DISPLAY

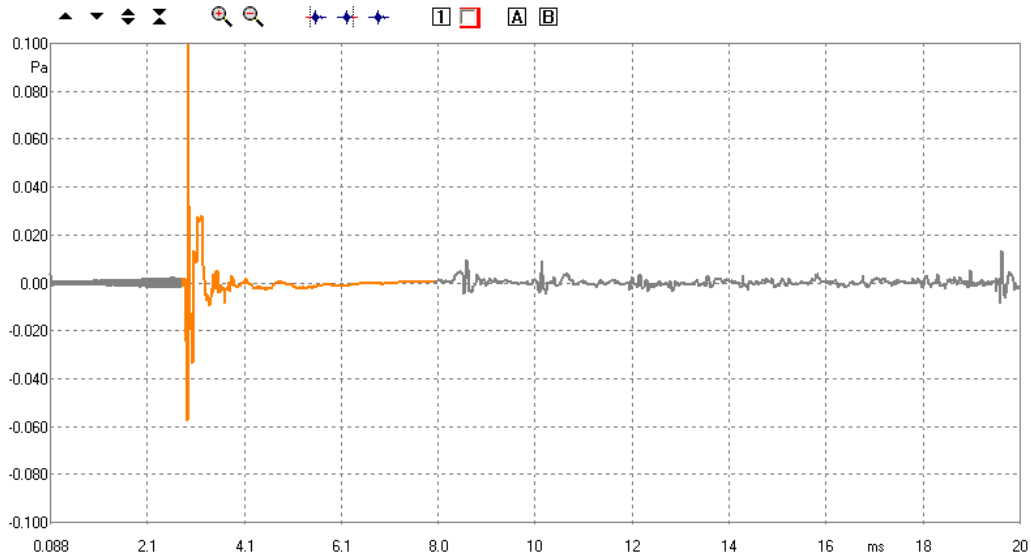


Figure 6.2

In this case there is only one overlay. It is also possible to **select** a portion of the main curve by means of three particular buttons. The selected portion of the main curve is identified by a **start** and **stop** point and is drawn in a different color from the unselected portion.

Defines the **start point** of the selection. **Before clicking with the button activate Marker A and position cursor to the desired point.**

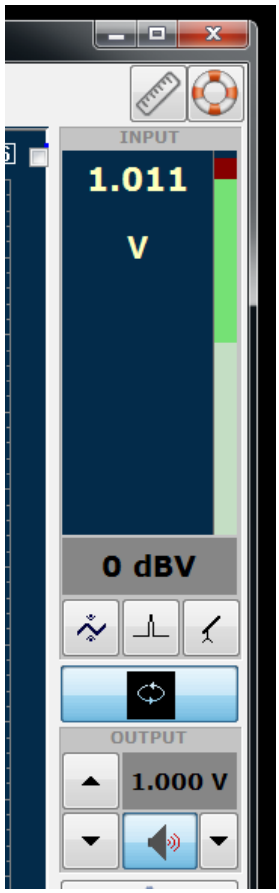
Defines the **stop point** of the selection. **Before clicking with the button activate Marker A and position cursor to the desired point.**

Returns the curve to a completely unselected state.

2.5 INITIAL TEST MEASUREMENT

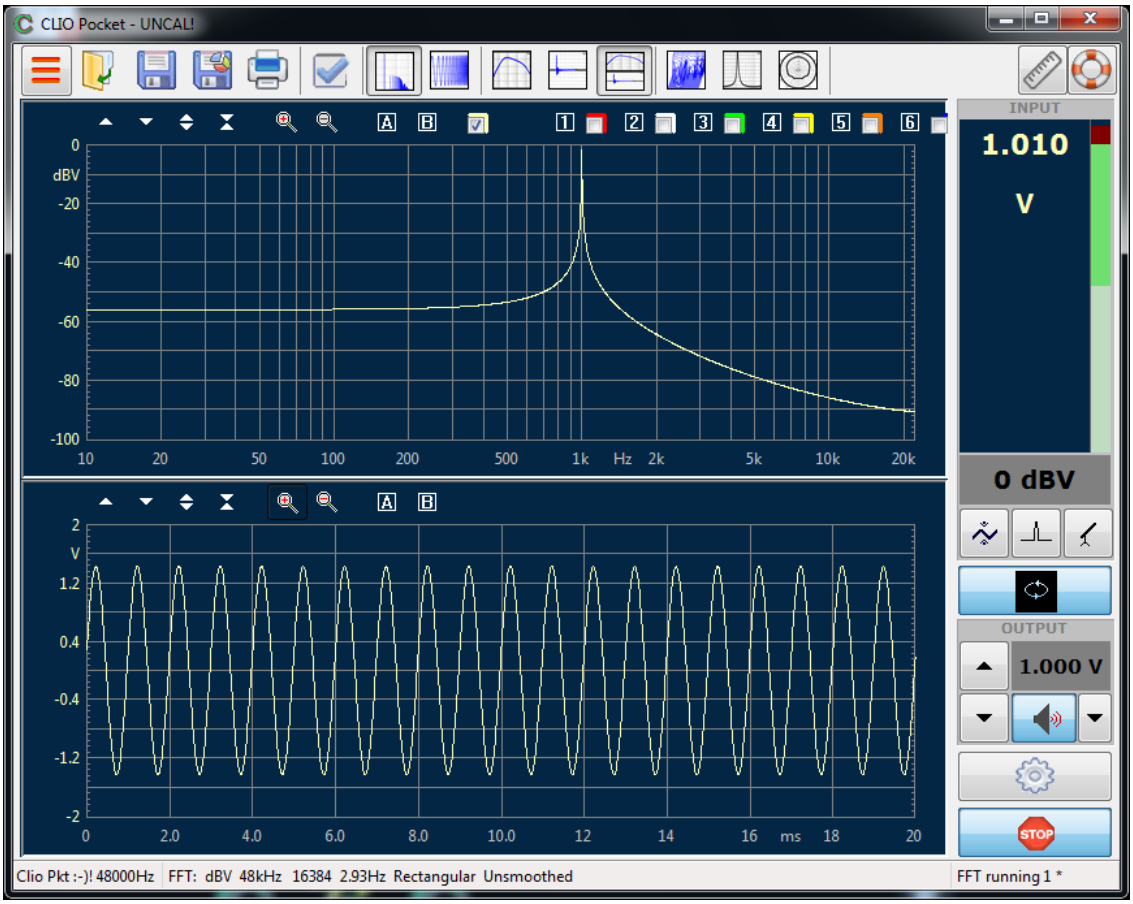
Let's now execute our first test measurement: to play and capture a 1kHz sinusoid. The In-Out Loop button should be **down**, click on it if not; in this way CLIO connects output with input with an internal relay. This connection is very important as it lets you capture and analyze a signal generated by CLIO without the need for an external connecting cable.

Then click on the generator icon to play a 1kHz sinusoid, it's the default signal. The input meter should react as in Figure and display the level in Volts of the signal at the input.



If everything is OK you should obtain a reading of circa 1V, variable between a minimum of 0.95V and a maximum of 1.05V, which is the mean output level of a sinusoidal signal when the system is not calibrated.

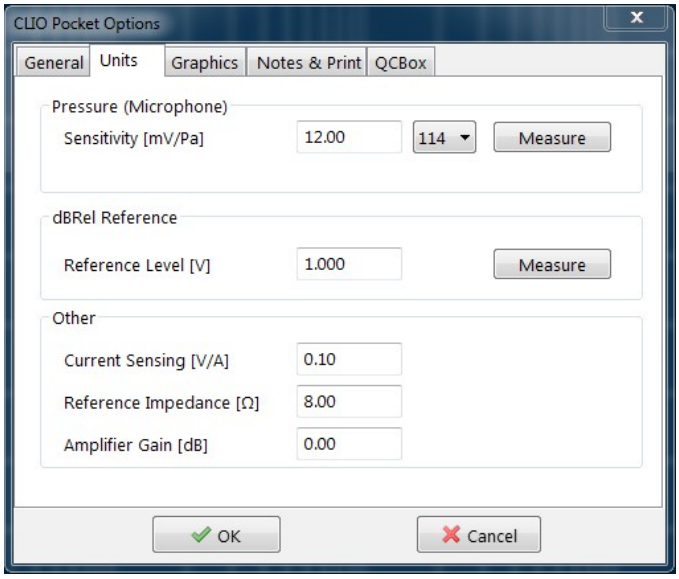
Now press the FFT button, the Frequency and Time Graphs button and finally the Go Button.



The result you should obtain is an FFT analysis of the 1kHz sinusoid and its time representation given by its waveform.

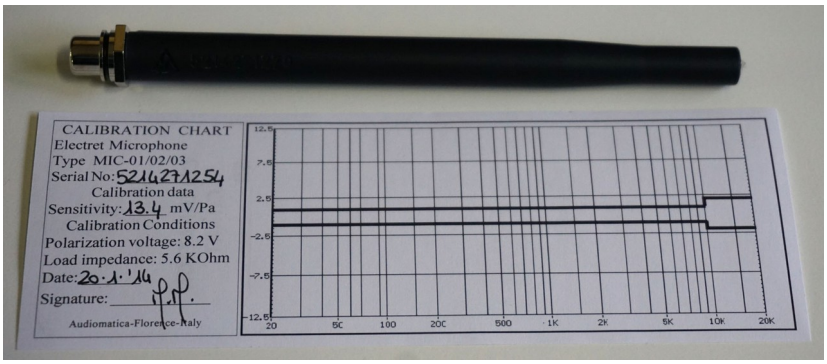
2.6 MICROPHONE SENSITIVITY

As seen, the main and default measurement unit of the instrument is AC voltage. Before taking measurements in different units, such as dBSPL, you must input the proper transducer sensitivity. To do this open the Options>Units dialog



To prepare CLIO Pocket to take SPL measurements set your microphone sensitivity inside this dialog; you may read it from the calibration chart that comes with your

microphone:



In the case of figure input 13.4 mV/Pa in the Pressure>Sensitivity edit box.

3 CALIBRATION

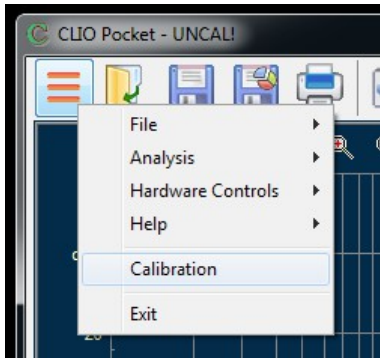
3.1 SYSTEM CALIBRATION

This section describes how to perform the system calibration.

Proceed only if previous test succeeded!

Be sure that, any time you perform a calibration, the system has warmed up for, at least 15-20 minutes. If done too soon you may receive the **Calibration Failed** warning message; in case repeat the procedure after a while.

Select **Calibration** from the **Main** menu



Leave the CLIO Pocket front plugs unconnected when calibrating.

At the end of the calibration process the UNCAL! warning is removed from the title of CLIO Pocket window; it is mandatory to verify the calibration itself; this is done by two simple measurements as described in the following section.

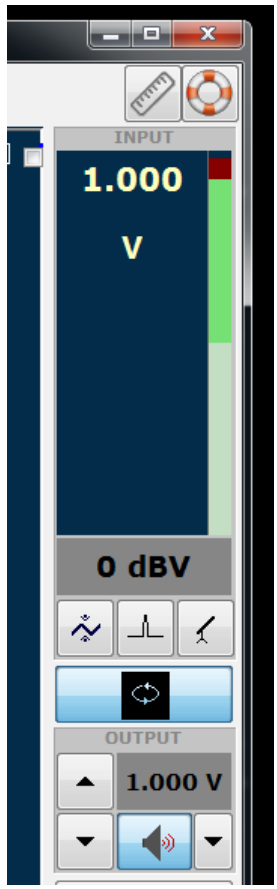
3.2 CALIBRATION VALIDATION

To verify the calibration:

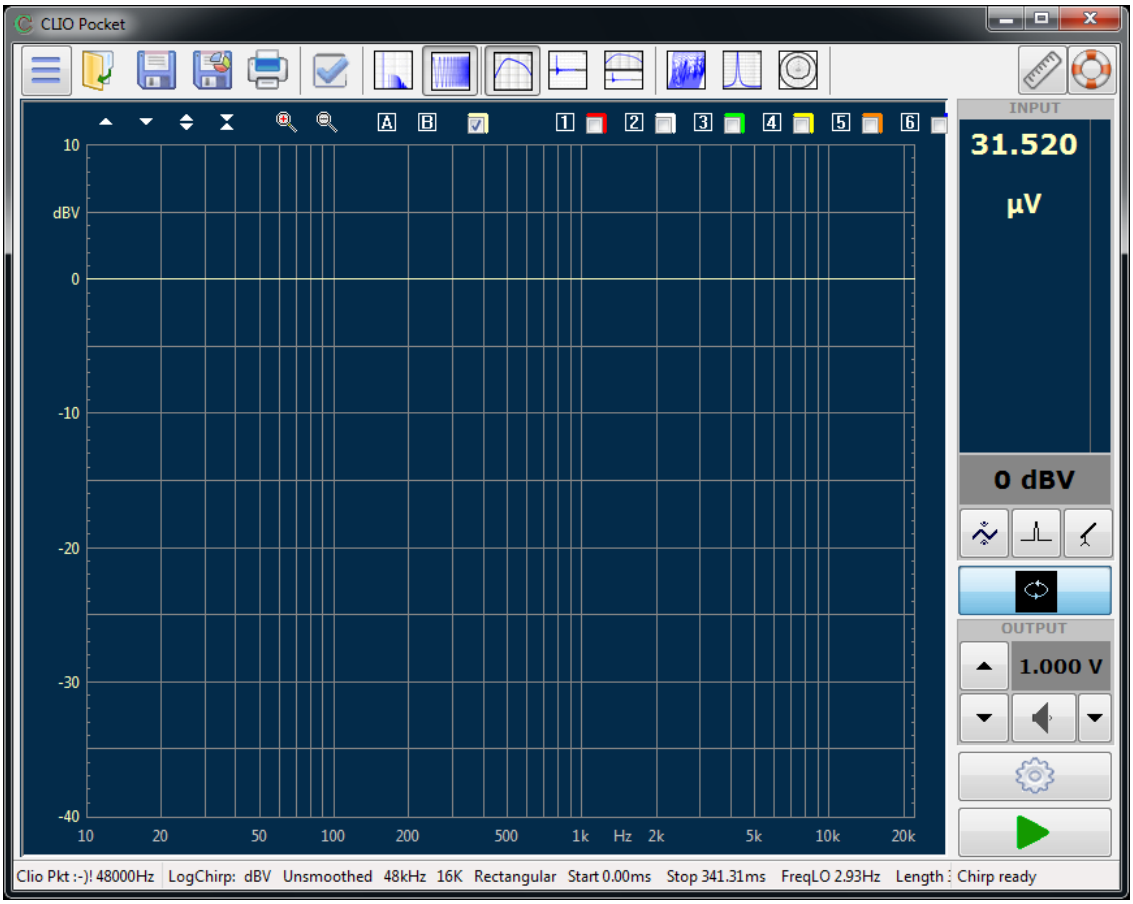
STEP 1: check that the generator output level is set to 1V and that the Input Full Scale Level is 0dBV.

Press the In-Out Loop button .

Repeat the initial test described in 3.5; you should now obtain the following reading:

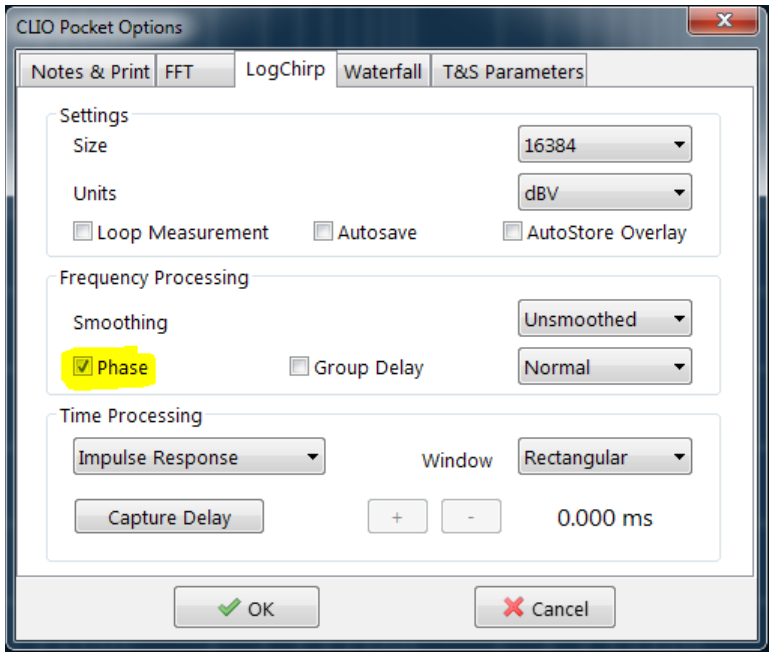


STEP 2: Then click on the LogChirp button to invoke the LogChirp panel and press the Frequency Graph button. Press the Go button to execute a LogChirp Frequency response measurement; after about **1 second** you should obtain the desired result, a straight line as in the following Figure.



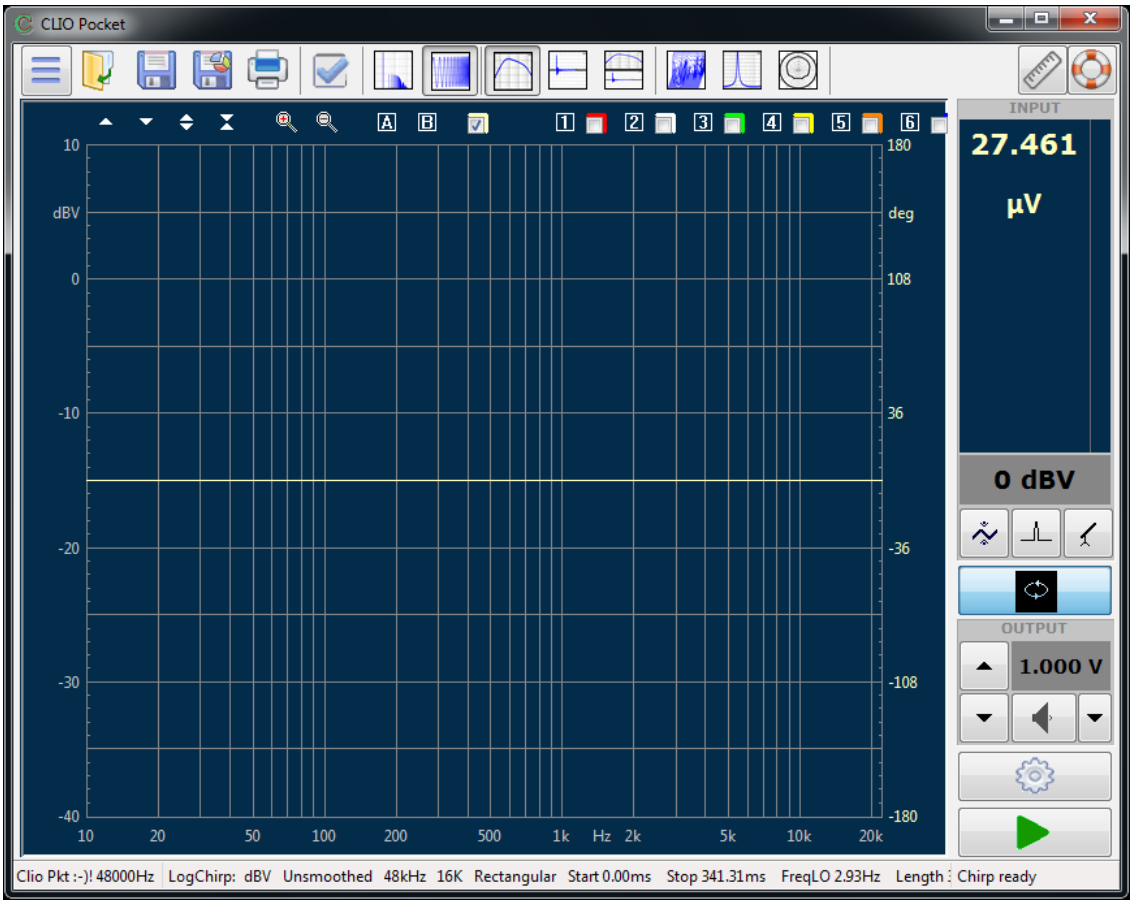
You can click on the marker [A] button and inspect the amplitude of the measured signal: you should obtain a reading around 0dBV, this is the correct output level of the LogChirp signal with the generator output set to 1V.

Now click on the Measurement Settings button to invoke the Log Chirp Settings dialog as in Figure.



Click on the **Phase** checkbox and press OK.

The measured phase response should be displayed.



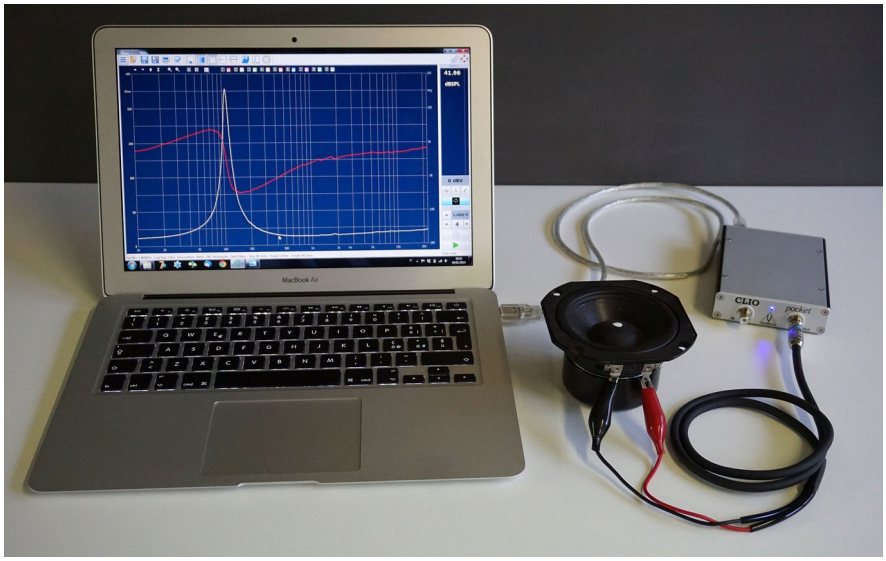
The correct readings should be around zero degrees.

3.3 TROUBLESHOOTING CLIO INSTALLATION

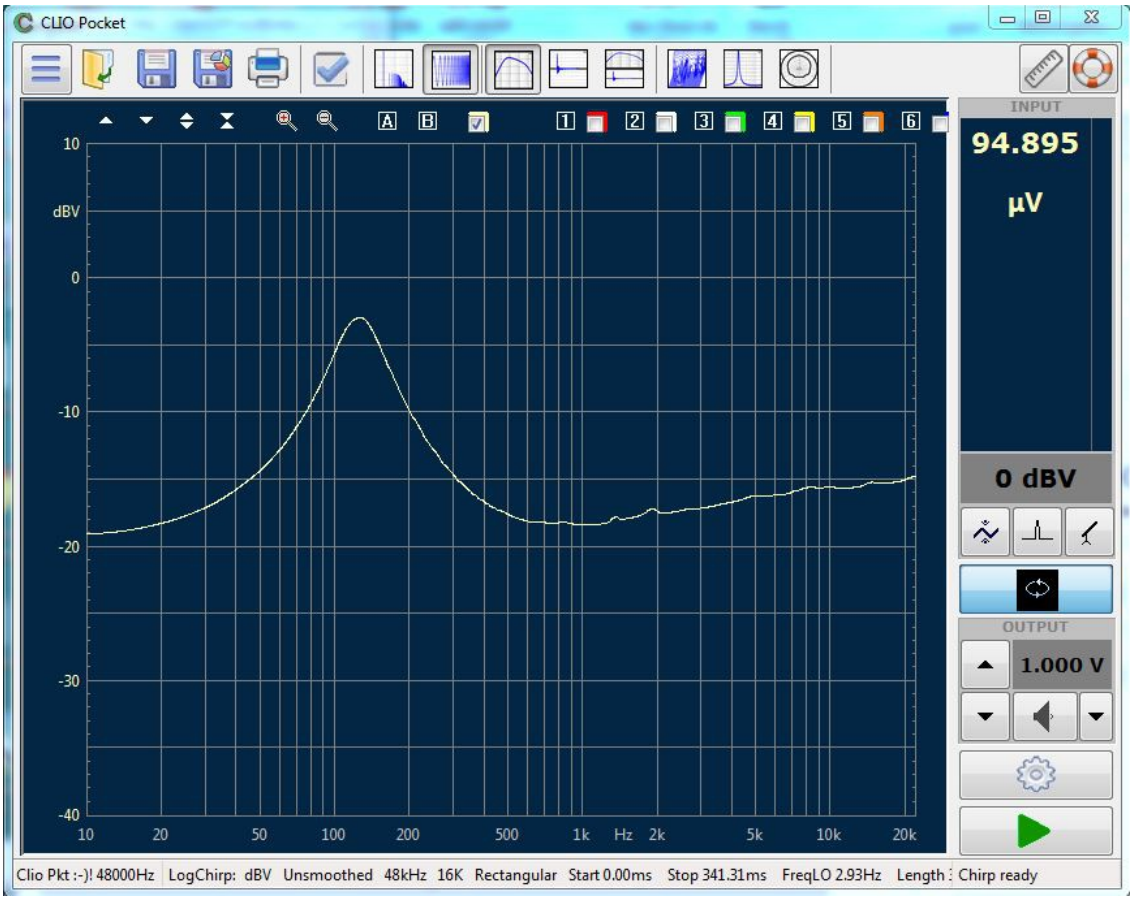
To receive assistance please contact Audiomatica at support@audiomatica.com or connect to our website www.audiomatica.com.

4 ENJOY CLIO POCKET

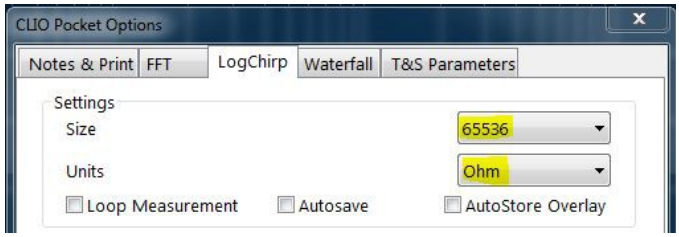
4.1 IMPEDANCE MEASUREMENTS AND T&S PARAMETERS



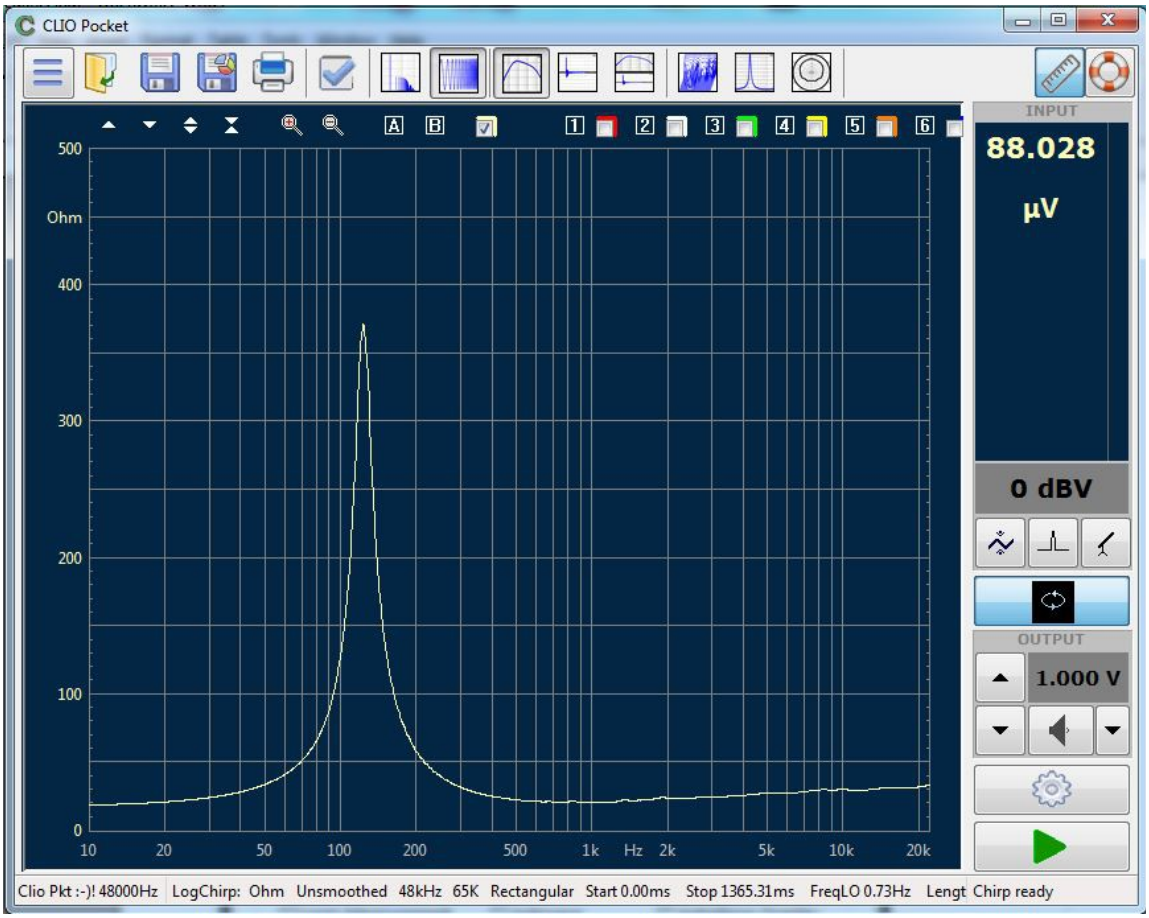
Once the Calibration has been verified it's time to start performing some measurements. Loudspeaker Impedance can be measured with CLIO Pocket out of the box. Connect the RCA to Alligator Impedance Cable to the CLIO output and to the Loudspeaker terminals (as in the Picture). Verify that the loop button is still down. Select the LogChirp Analysis. Basically everything should, for now, be left unchanged since the measure done to validate the calibration. Performing a new measure with the loudspeaker connected something like the following should appear on the screen:



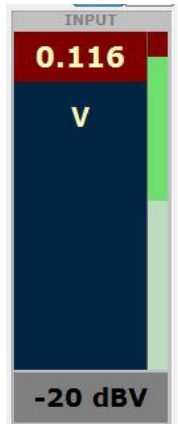
Actually this is not an Impedance Curve, but a Frequency Response showing the log scaled voltage division of CLIO's output impedance with the loudspeaker's input impedance. Open the LogChirp Settings and change both Size to 65536 and Units to Ohm.



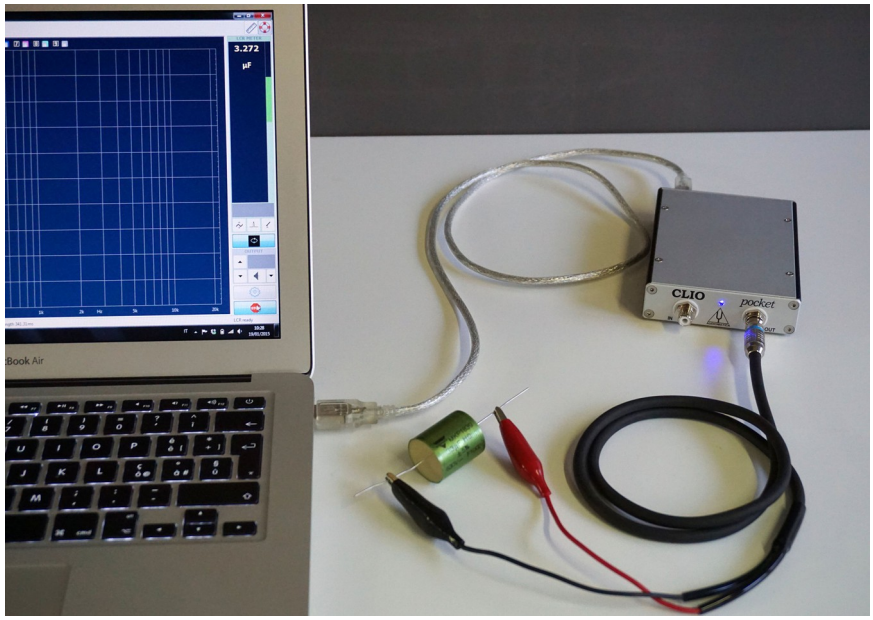
With the latter settings, perform the measure again. We finally get an impedance measurement:



Obviously yours should be different with a similar shape. You will have to adjust the Y scale either manually or with the AutoScale Button. Why we changed Units to Ohm should be obvious. Increasing the Size of the Measurement and relative FFT brings enhanced low Frequency resolution. This is advisable measuring woofers and midranges. The default output level of 1.000V is fine in most cases, but can be increased with high impedance devices. Input level should be set to the maximum gain before overload occurs to. This maximize SN ratio. For 1.000V output 0dBV is a good starting point.



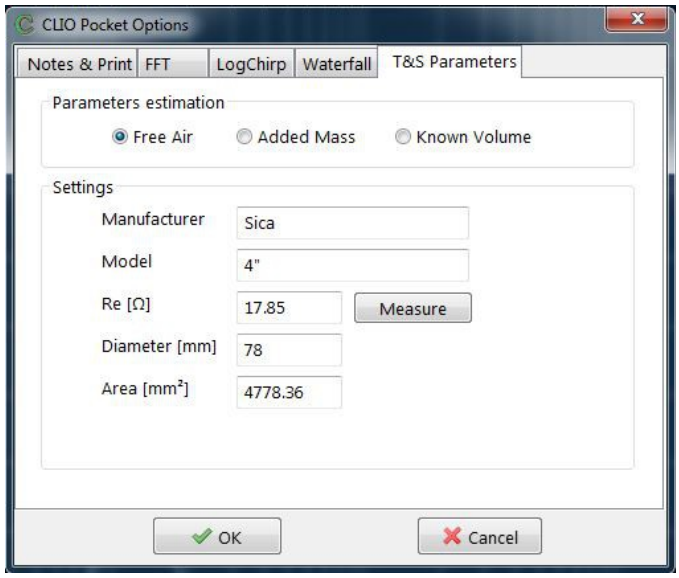
Before dealing with how to calculate T&S Parameters, which is a post-processing of Impedance Measurements, let's be sure that we have everything set by measuring Capacitors and Inductors. Just disconnect the Loudspeaker and replace it with either of the two.



Click on the Units label within the Level Meter and select the correct measurement units for the component under test (Resistance, Capacitance, or Inductance). Then press the ▶ arrow that starts all measurements and you should see a real time measurement.

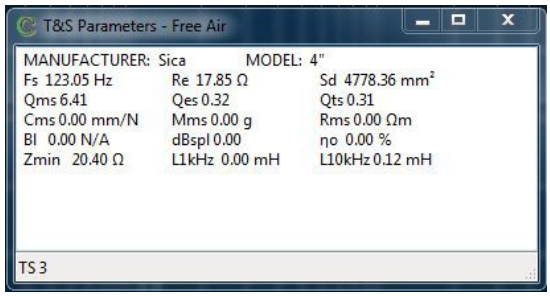
We end this chapter by covering T&S Parameters, because these are calculated by post-processing impedance measurements. One obtained in free air, which means with the Loudspeaker as is, the second acting a perturbation on the moving part that can be either an Added Mass or a Known Volume. In the first case the Resonance Frequency will decrease, in the second increase. Our example will be with Added Mass as it is usually easier to achieve.

While the whole procedure can be carried with Impedance present in memory but not saved, we strongly suggest that you carry out the two measurements and save them with meaningful names. It is a good idea to include the amount of Mass (or Volume) used in the name of the second file while "FreeAir" is a good choice for the first.

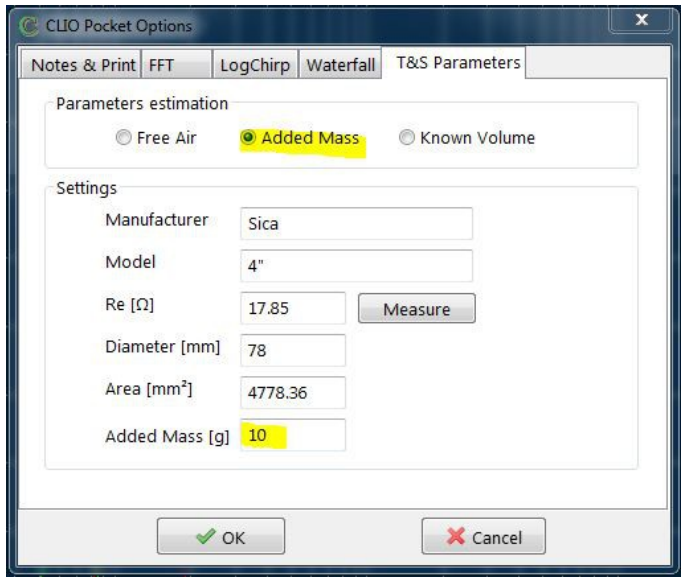


With the Free Air measurement in memory open the CLIO Pocket Option Dialog and choose T&S Parameters Tab. Check that Free Air Radio Button is selected and fill the required data.

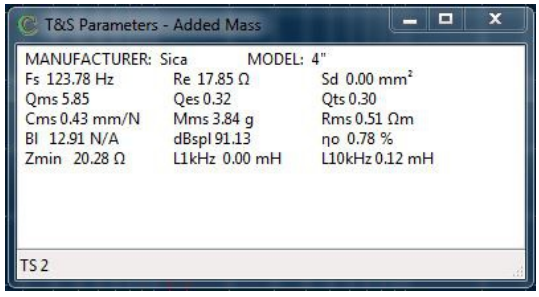
Note that if the Loudspeaker is connected the DC resistance Re can be directly measured by CLIO clicking on the Measure button. Also notice that Diameter and Area are either/or options. You may set one and the other will be set accordingly once the field is exited. Confirm and Close pressing OK. Now Clicking on the T&S Parameters Button the Free Air parameters should appear.


T&S Parameters - Free Air
MANUFACTURER: Sica MODEL: 4"
Fs 123.05 Hz Re 17.85 Ω Sd 4778.36 mm²
Qms 6.41 Qes 0.32 Qts 0.31
Cms 0.00 mm/N Mms 0.00 g Rms 0.00 Ωm
Bl 0.00 N/A dBspl 0.00 ηo 0.00 %
Zmin 20.40 Ω L1kHz 0.00 mH L10kHz 0.12 mH
TS 3

To get the complete set of Parameters load the Added Mass Impedance file and, again recall the CLIO Pocket Options, T&S Tab

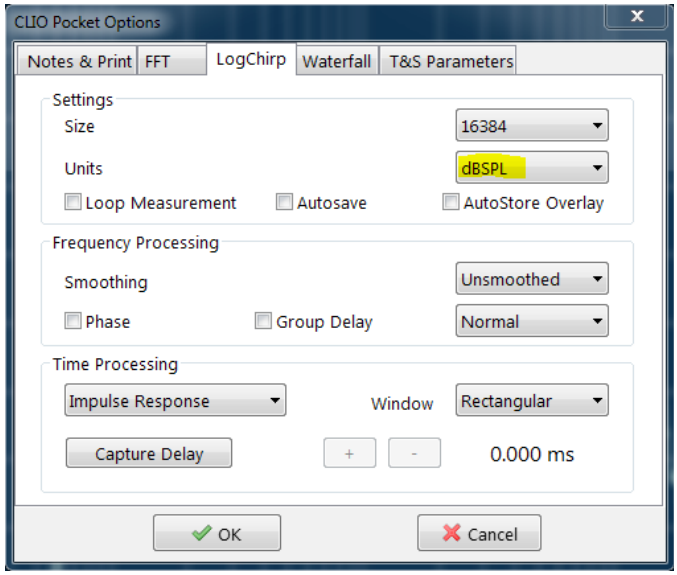


By selecting the Added mass Radio Button the Added Mass value input will appear. Input the weight of the used mass and confirm with the OK Button. By clicking the T&S Parameters Button again, the complete set of T&S Parameters should appear.


T&S Parameters - Added Mass
MANUFACTURER: Sica MODEL: 4"
Fs 123.78 Hz Re 17.85 Ω Sd 0.00 mm²
Qms 5.85 Qes 0.32 Qts 0.30
Cms 0.43 mm/N Mms 3.84 g Rms 0.51 Ωm
Bl 12.91 N/A dBspl 91.13 ηo 0.78 %
Zmin 20.28 Ω L1kHz 0.00 mH L10kHz 0.12 mH
TS 2

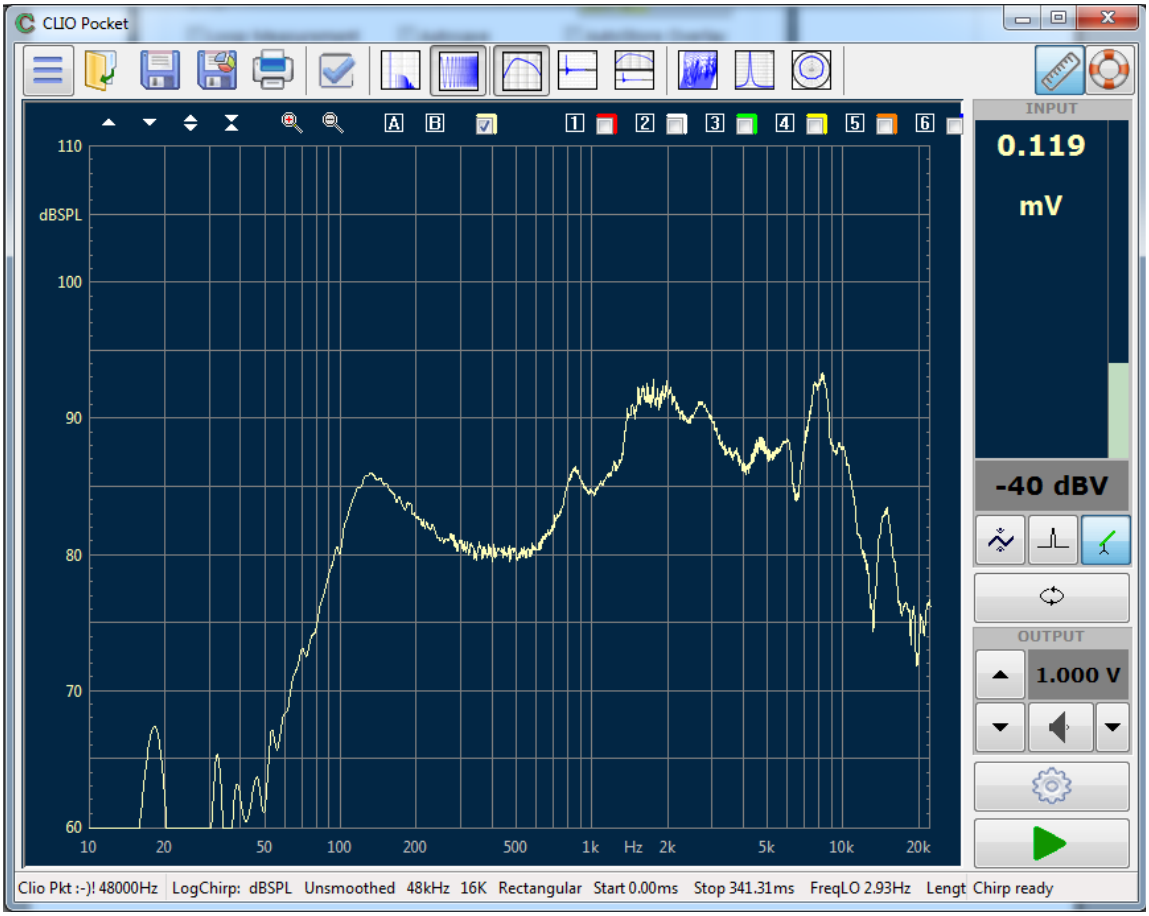
4.2 CONNECTING THE MICROPHONE

If, up to testing T&S Parameters, everything has worked as described, is now time to connect the microphone. Leave the loudspeaker connected as for impedance. Using the RCA to RCA 2.7m long microphone cable connect the MIC02 to the CLIO Input. Check you have set the correct Sensitivity as written in 2.3. Put the microphone in the Speaker Nearfield as shown in the picture above. Turn the Mic Power Supply on. Release the In-Out Loop button. This disconnects the CLIO input from its output, connecting the input only to the RCA socket and therefore to the microphone. Click on the LogChirp button and then the Measurement Settings button to invoke the Log Chirp Settings dialog:



Choose dBSPL as unit, set everything else as above confirm with the OK button and

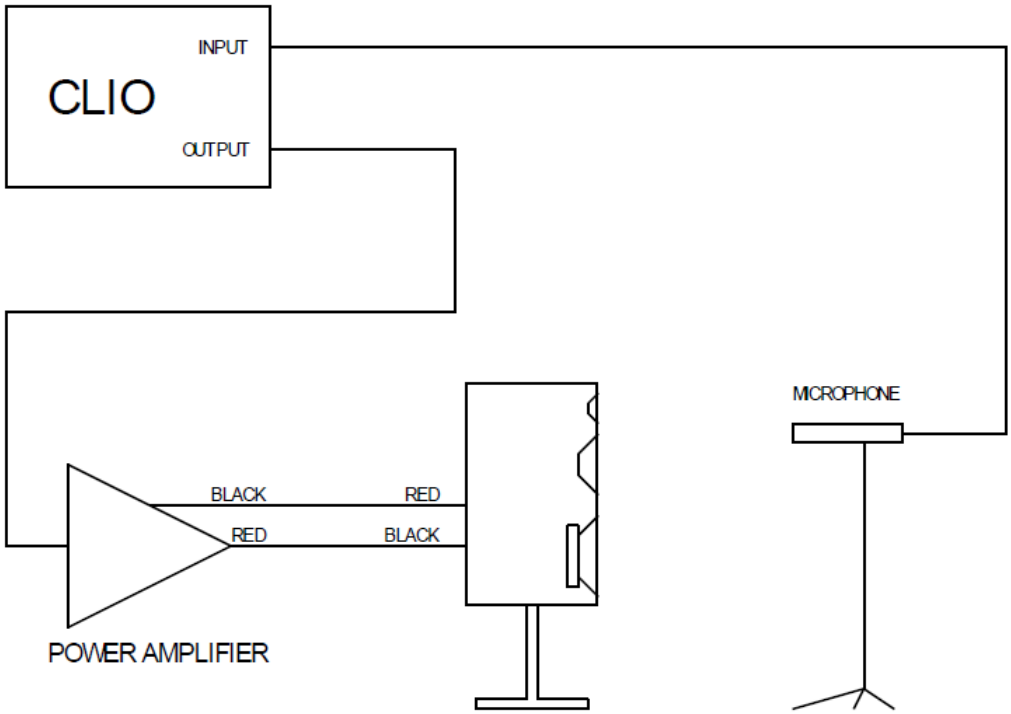
perform the measurement .



Repeat measuring and adjusting Input Gain until the maximum before overload. In the figure above we have it set at -40dBV (10mV) full scale which is the highest possible Input Gain. Depending on the speaker this might change. You can also safely increase or reduce the Output level to keep the response within 80 to 90 dBSPL. You should obtain a Pressure Frequency Response even if, for several reasons, it is not the real one of the speaker. Try to get confident with this measurement, which is absolutely safe for the speaker because CLIO does not have a high power output. Even with Output set at its maximum 3.4V, it is unlikely that even a micro speaker would fail, because it is connected via a 150 ohm resistor. If you are confident so far, it is time to try to perform an anechoic Frequency Response of a loudspeaker system.

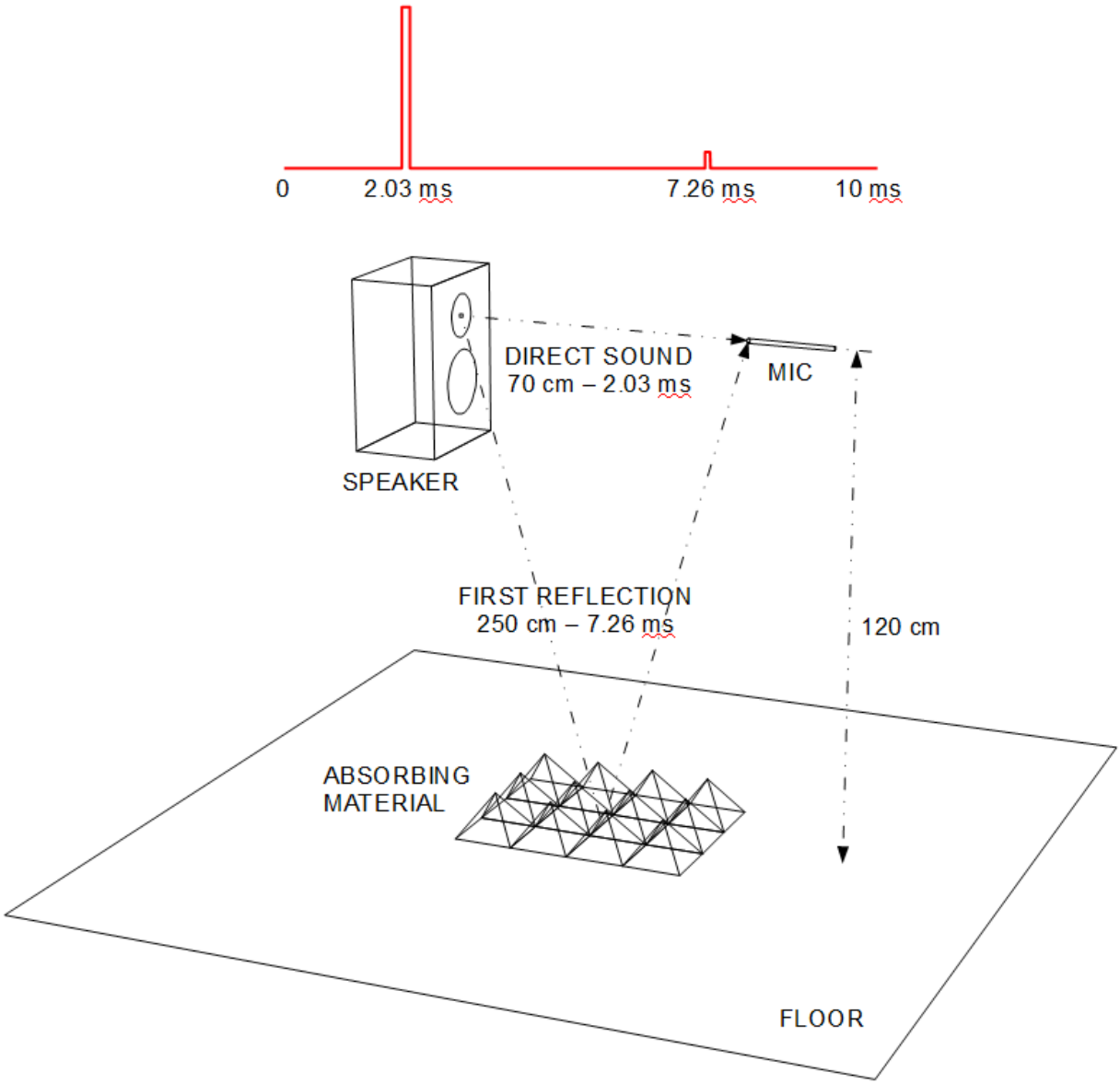
4.3 ANECHOIC FREQUENCY RESPONSE OF A LOUDSPEAKER SYSTEM

Up to now what was in the CLIO box was sufficient. To proceed now you have to connect your own audio power amplifier via an an RCA cable. The amplifier should possess a flat Frequency Response and a low output impedance. Check that the CLIO generator is turned OFF and that the amplifier is turned OFF. Connect CLIO's Output to the amplifier input and the amplifier's output to the speaker you are measuring. Refer both to the above picture and the schematic below



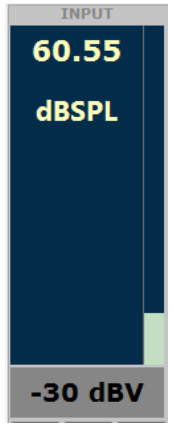
Note that the polarity of the cable from the amp to the loudspeaker is inverted. This

compensates for the fact that the supplied MIC02 inverting the signal as do most measuring microphones. However, it is possible to correct this issue in a more elegant way using the Input Polarity button . In our example we will measure a relatively small two way loudspeaker. For a physical small speaker it is advisable to put the microphone at 50-70cm from the speaker, thus obtaining a longer reflection-free measurement than when testing at 1m. The greater the distance between both the speaker and the mic. from any reflecting surfaces, the better.

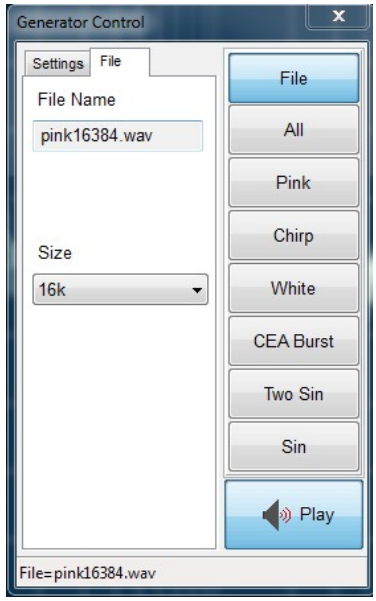


In the above figure you see the common practice of placing absorbing material to attenuate the first reflection. However be advised that, as long as this affects only high frequencies, it has the disadvantage of masking the exact arrival time by slowing the rise of the reflected impulse. Therefore, it is ideally better to delay the arrival time of the first reflection than to absorb it, if possible.

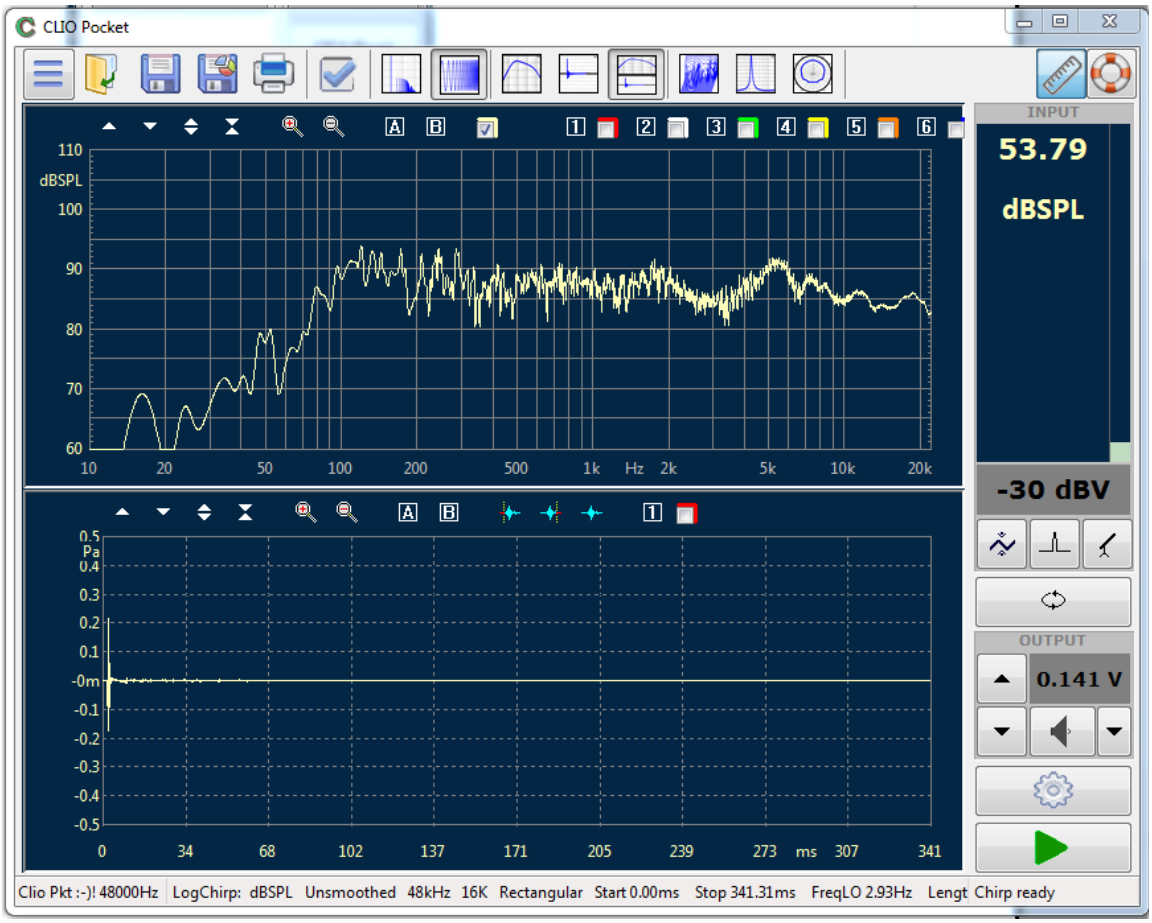
Once the set-up is ready, if there is a volume control turn it to the lowest position and switch the amplifier on. Check that the microphone power supply is on, set CLIO Input gain to -30dBV, and verify that the bar-graph on the right of the Level Meter responses to a hand clap. Set the latter to dBSPL.



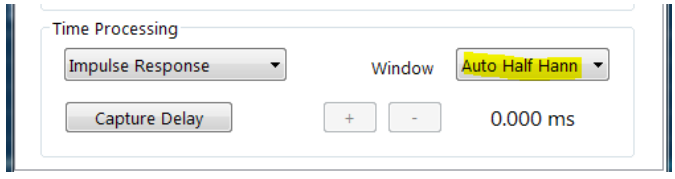
If there is a volume control on the amplifier it should have been already set counter-clockwise (to minimum). Therefore leave the CLIO Output level at its default 1.000V. In absence of a volume control on the amplifier set CLIO Output level at 0.01V or below. Open the Generator Control Panel and generate Pink Noise by clicking on Pink and then on Play. You can ignore the Size for now.



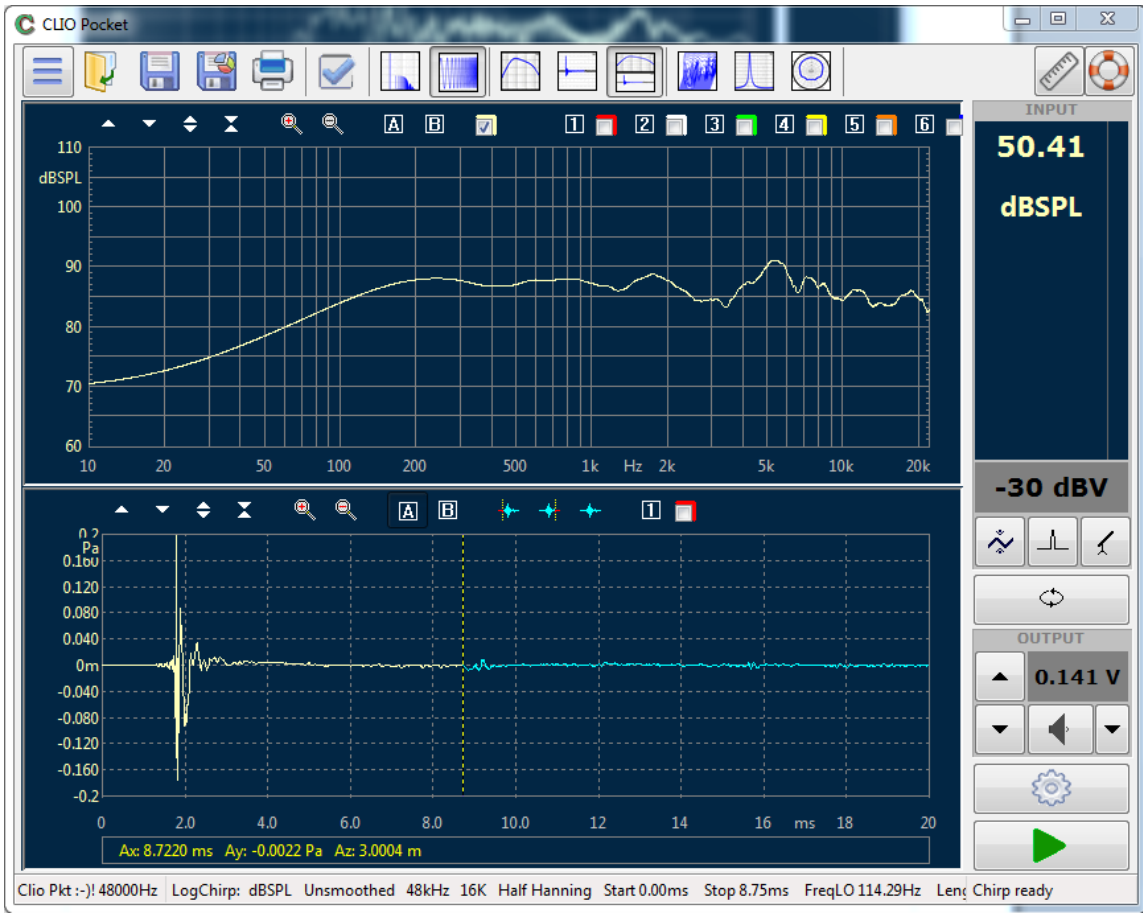
Either with the amplifier's volume control, or with the CLIO output level control arrows, increase the level(you should hear a sound like a waterfall, which is Pink Noise). Adjust the output to read around 80dBSPL on the Level Meter. Turn the Generator Off. Click on the LogChirp button to invoke the LogChirp panel and press the Frequency & Time Graph button so that you have Frequency and Time Domains visible at the same time. Press the Go button to execute a LogChirp Frequency Response measurement with exactly the same settings shown for the Nearfield measurement.



Here we have Frequency and Impulse responses. The Frequency Response is not Anechoic. In the Time Domain, Zoom both X and Y axes to fit your situation of impulse and reflections. Eventually temporarily select the Time Domain only Button for a bigger and more detailed Impulse. Activate Marker A, verify that the distance of the peak of the Impulse is what you expect, locate the first reflection, put the Marker A immediately before and click on the Set Stop Window Button . If you left both Domains visible, as suggested, you should see immediately how the Frequency Response changes. As a last refinement open the LogChirp Settings and in the Time Processing settings change the Window from Rectangular to Auto Half Hann.



Below is what we obtained. The Frequency Response is much smoother then before with less bass extension and a less steep high-pass behavior. The average level is in the 87dBSPL range, higher than what was measured using Pink noise. This is expected and correct.

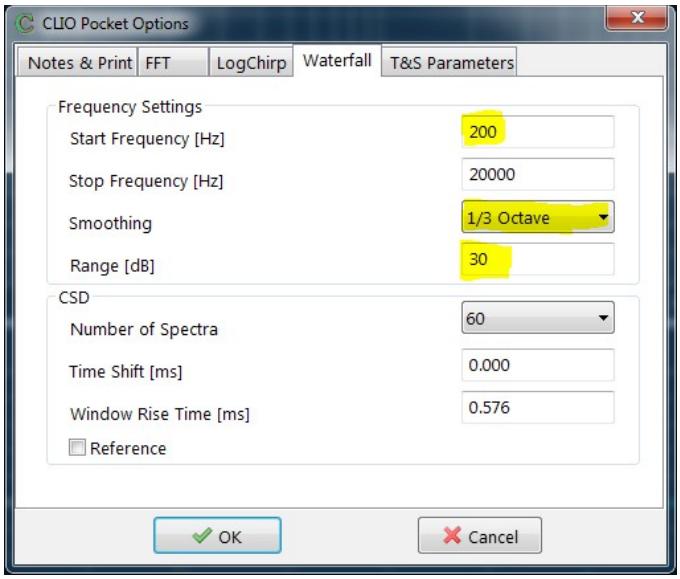


In the status bar, information regarding the measurements and its processing are reported. With the stop window set at 8.75ms and an impulse arrival time of 1.8ms the low frequency reliability limit is around 150 Hz. We did not set the Start Window, because it does not change the Frequency Response. If you are interested in anechoic responses it is unlikely you need a bigger measurement size than 16k, but for room acoustics 64k is advisable.

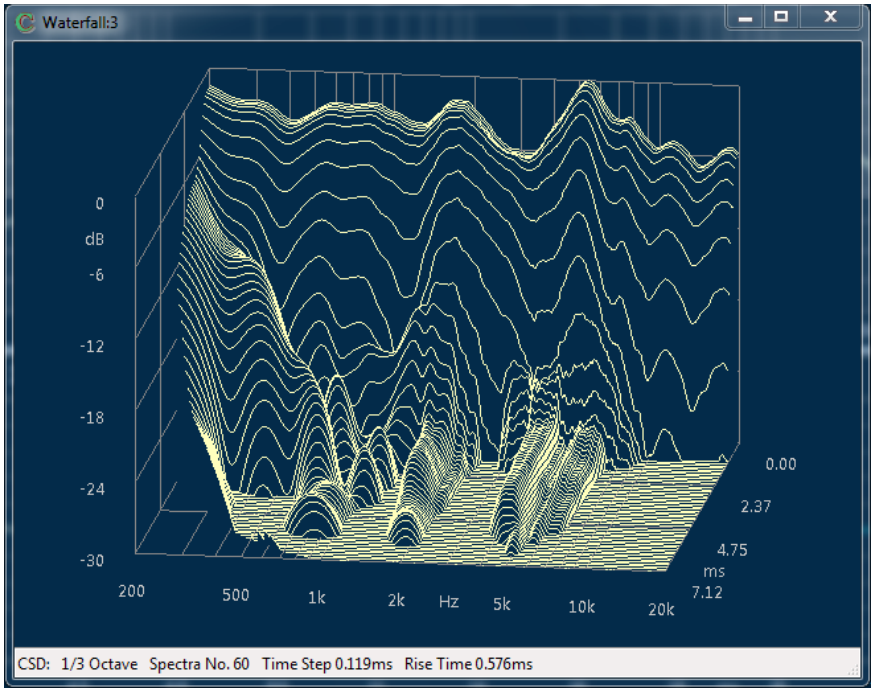
4.4 WATERFALL

The 3D decay of the anechoic response, known as the Cumulative Spectral Decay, is achieved by the Waterfall post processing.

Open the measurement settings dialog and choose Waterfall. Input: Start Frequency 200Hz, Smoothing 1/3 Octave, Range 30dB.



Click of the Waterfall button.



Click with the mouse over it and enjoy.

4.5 IN-ROOM MEASUREMENTS

We are going to execute two acoustical FFT measurements that characterize the quality of perceived sound and the room environment surrounding us.

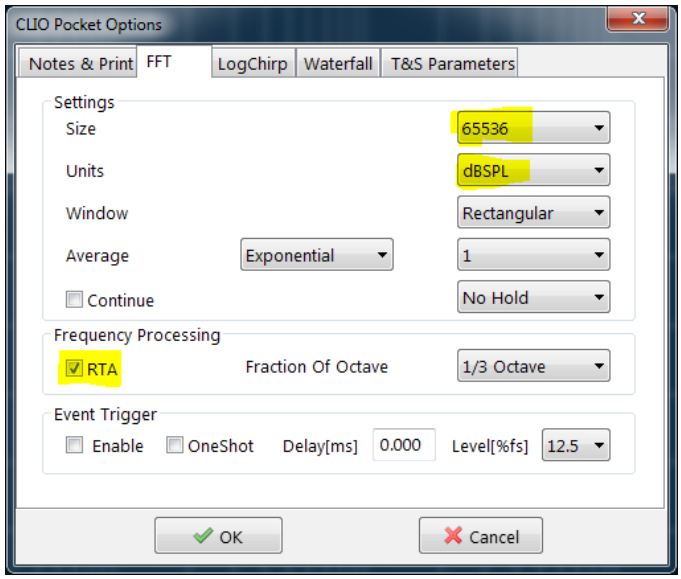
Both measurements are done at a listening position; the first tells us about the overall tonal balance and is done with third-octave RTA analysis; the second aims to give us an idea of room behavior with respect to decay of sound.

Unlike Log Chirp measurements, FFT and RTA are interactive; the user can chose either to generate a particular stimulus signal or simply analyze what is present at the mic input. When possible, when using a stimulus, it is advisable to use CLIO's internally generated signals because they lead to more precise and powerful analyses. Here we describe two examples exploiting both methods.

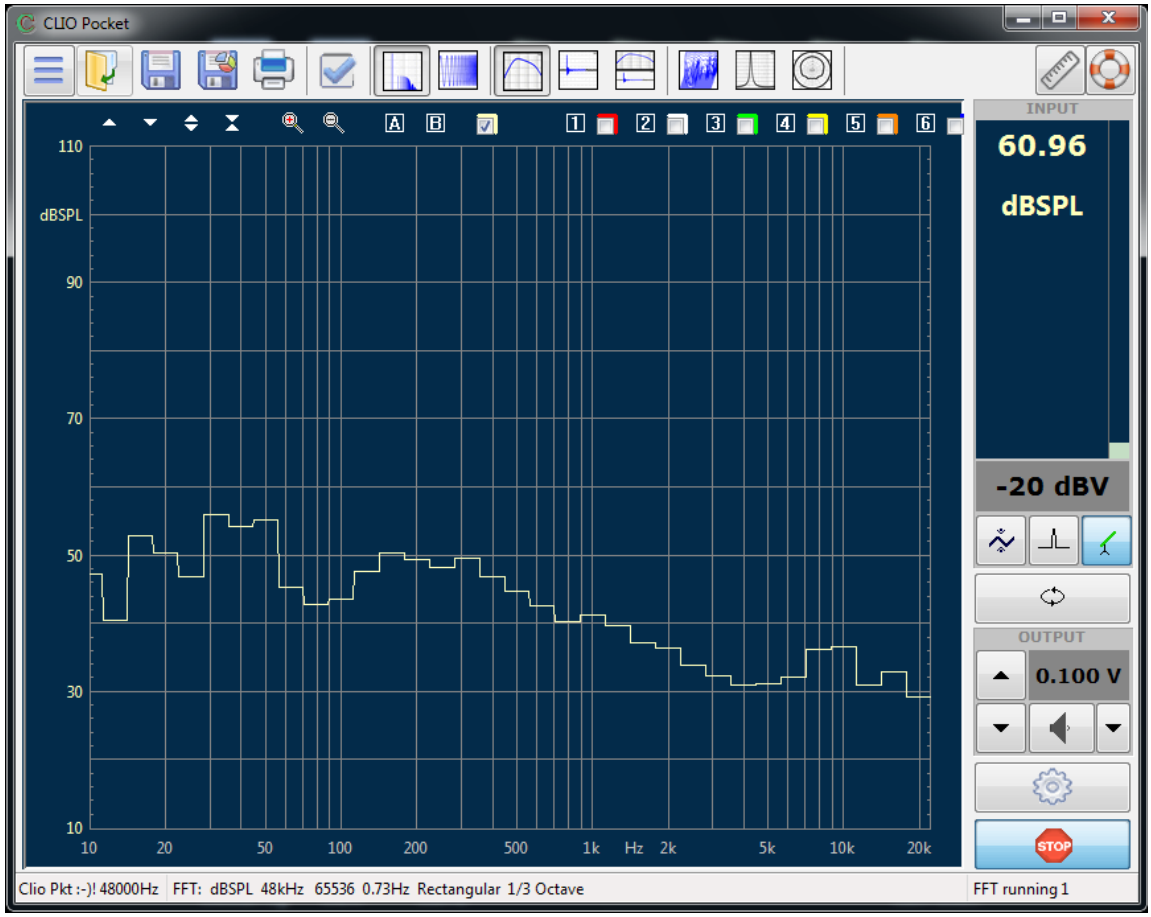
Let's prepare for our RTA measurement with an example. As seen in the photo above, we have placed a Rogers-like loudspeaker in our listening room for measuring.

To measure a loudspeaker in a similar situation, place the microphone at a listening position and connect the mic. cable to the CLIO input. Set the Mic Power Supply to ON ; In-Out Loop to open (i.e. button released); Input Sensitivity to -20dBV. Set CLIO's Output Level starting low, say 0.1V, and the CLIO generator to OFF . With the power amplifier turned OFF, and the volume control to minimum, connect the CLIO output to the power amplifier line input and then you may turn the power amplifier on.

Press the FFT button, then enter FFT Options and set Size to 65536, Units to dBSPL and check the RTA box.

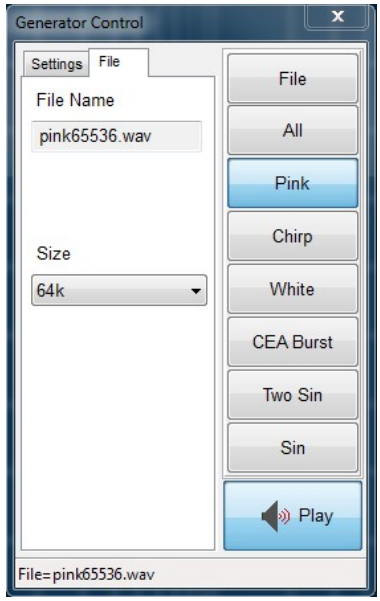


Close the dialog, set the Meter units to dBSPL, press the FFT Go button to start the analysis. Because the generator is still OFF you should be analyzing only the fluctuating noise of the room.

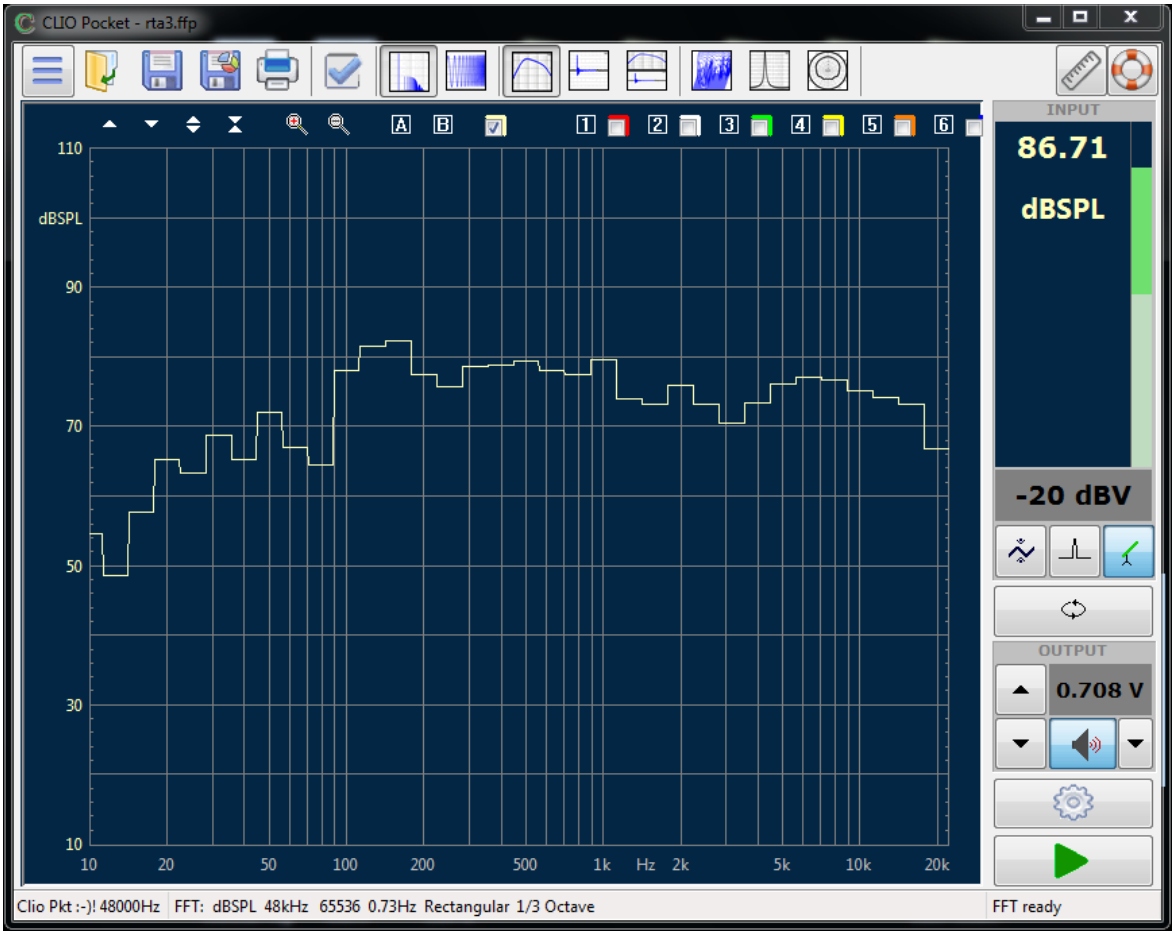


Now prepare the generator; click on the Generator Control Panel button aside the Generator ON/OFF one

a new window should pop up, from here it is possible to generate the required signal for our analysis; choose Pink and select 64k Size from the drop down.



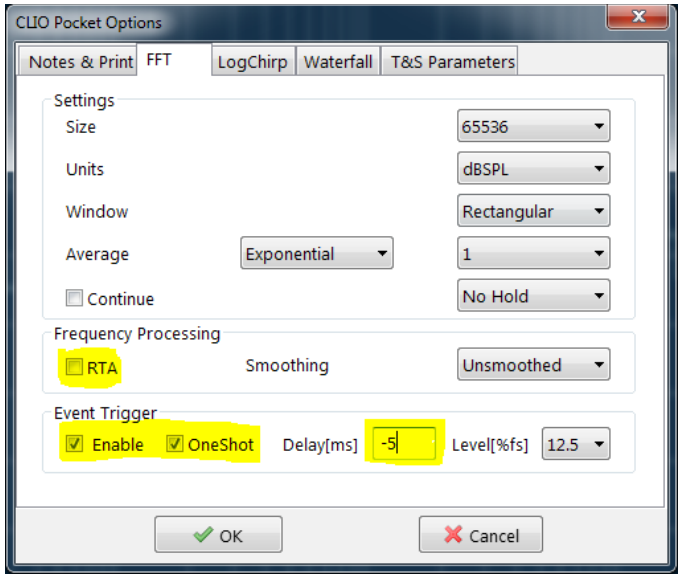
Note that we left Averaging equal to 1 in the FFT settings because we are using a pseudo-random pink-noise stimulus of same length as the FFT size. Press Play; you should hear Pink Noise out of the speaker and view the RTA Frequency Response on screen, with the average level of the signal shown in the Meter box. Now carefully increase the Output until you reach a realistic listening level, for these speakers say 87 dBSPL. You may then capture your Frequency Response by pressing STOP.



Switch Generator OFF (or simply press **ESC**).

We are now ready for the second FFT acquisition. You may disconnect the power amplifier because now we will rely on an external stimulus by means of an inflated balloon.

We are going to analyze the explosion of the balloon, which will give us a measure of the impulse response of our room. Open the FFT Option dialog and uncheck the RTA box, set the Event Trigger to Enable and One Shot, and input -5ms into the Delay edit box.

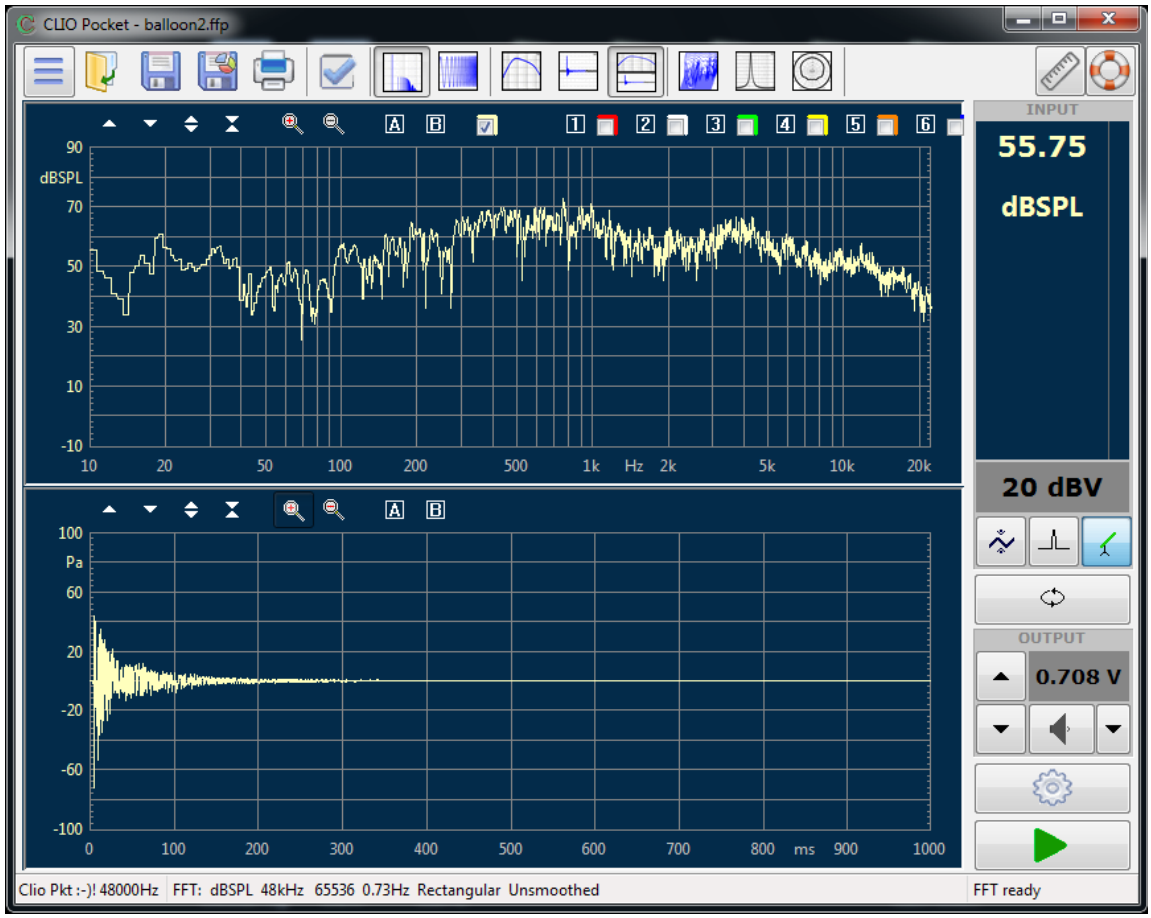


Close the dialog. Now set Input sensitivity to +20dBV to avoid overload, because the balloon explosion, even for small balloons, provokes high peak pressures.

Press the Frequency&Time Graphs button; go into the lower time graph and press the Zoom Out button until the right time scale reaches 1000ms. In this way we will see most of FFT acquisition (which is 1.37s @ 64k samples @ 48kHz).

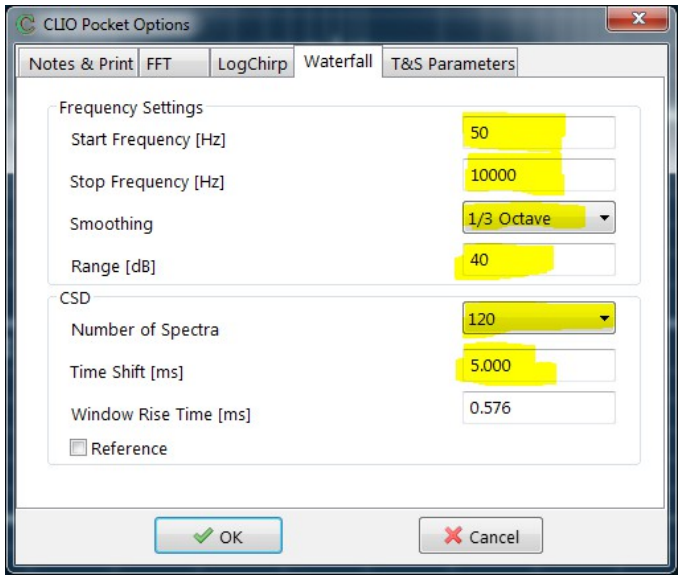
Start FFT acquisition; the FFT is set in Event Trigger mode therefore, with only a small signal at microphone,the display should be frozen, with CLIO waiting for an event able to trigger acquisition. The **FFT running** display and a blinking cursor indicates this.

Now take the balloon, handle it in a location as in photo, explode it. If you are lucky here is what you get:

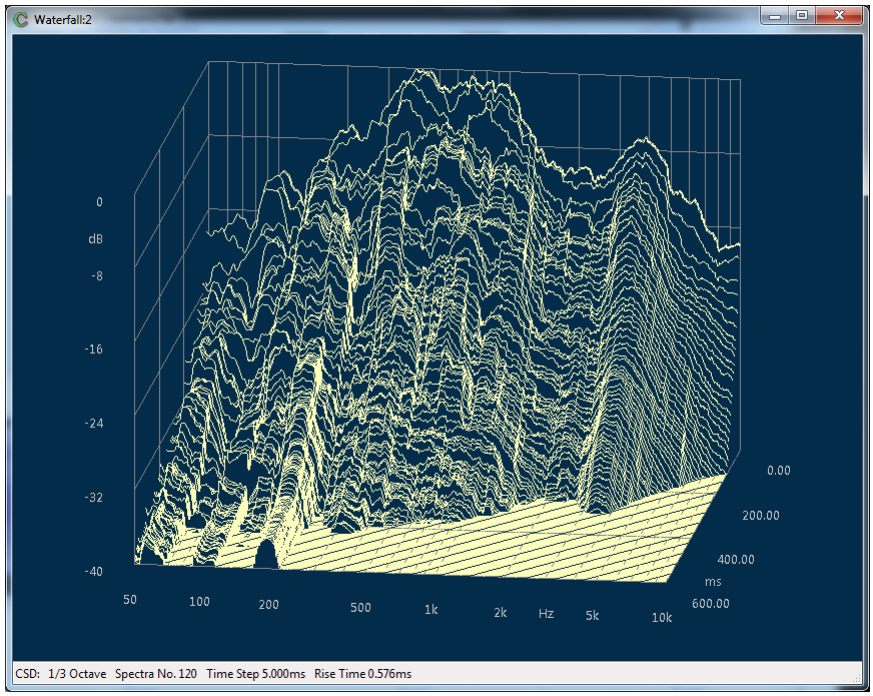


As shown in the lowest curve above, you should see the impulse and its decay, with the acquisition stopped, because it was set to One Shot only. Above the impulse response is displayed the corresponding narrow-band FFT response.

It is interesting to perform some decay processing on this acquired response. Open measurement Options again and choose the Waterfall tab. Set Start Frequency 50Hz, Stop Frequency 10000Hz, Smoothing 1/3 Octave, Range 40dB, Number of Spectra 120, Time Shift 5ms.



Click on the Waterfall button; the resulting graph tells you how sound decays in the room.


Waterfall:2
0
dB
-8
-16
-24
-32
-40
50
100
200
500
1k
2k
Hz
5k
10k
0.00
200.00
400.00
ms
600.00
CSD: 1/3 Octave Spectra No. 120 Time Step 5.000ms Rise Time 0.576ms

5 REFERENCES

[1] Joseph D'Appolito, “Testing Loudspeakers”, Audio Amateur Press, 1998.

[2] Joseph D'Appolito, “Testing Loudspeakers at low Frequencies with CLIO”

[3] Audiomatica Knowledge Base

[4] Audiomatica Products Literature

[4.1] CLIO 11 User's Manual

[4.2] CLIO 10 User's Manual